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Volume 7
Number 5
July 1989
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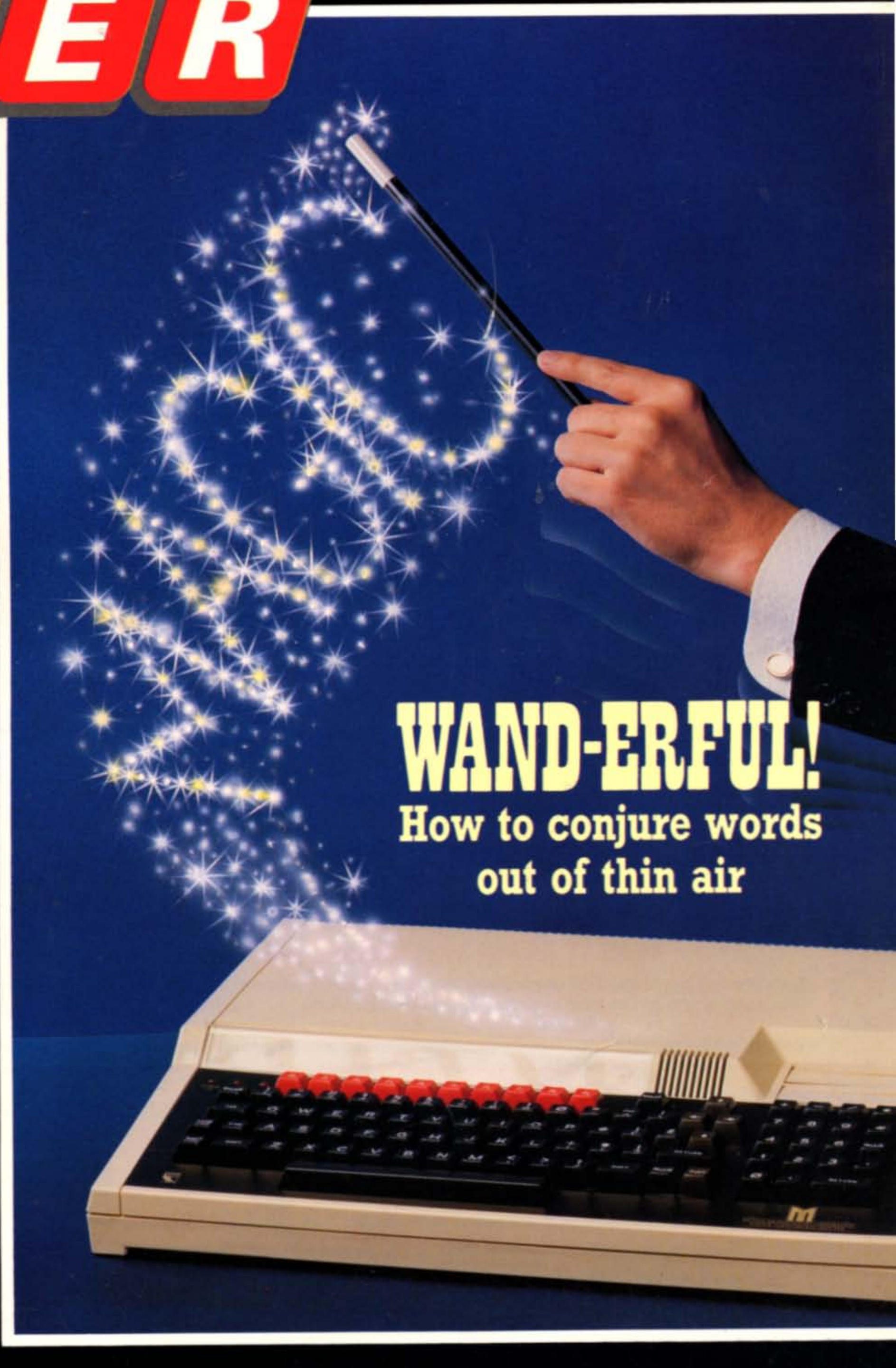

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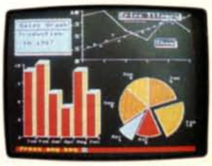
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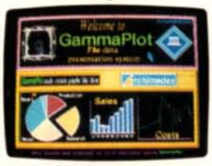
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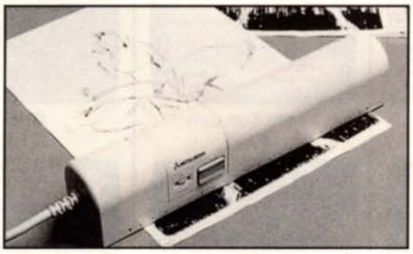

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Cover story

It's amazing!

Put the lights out. With just a few simple components you can create a fascinating toy for all the family to play with. Just turn to Page 22 and start waving the wand.

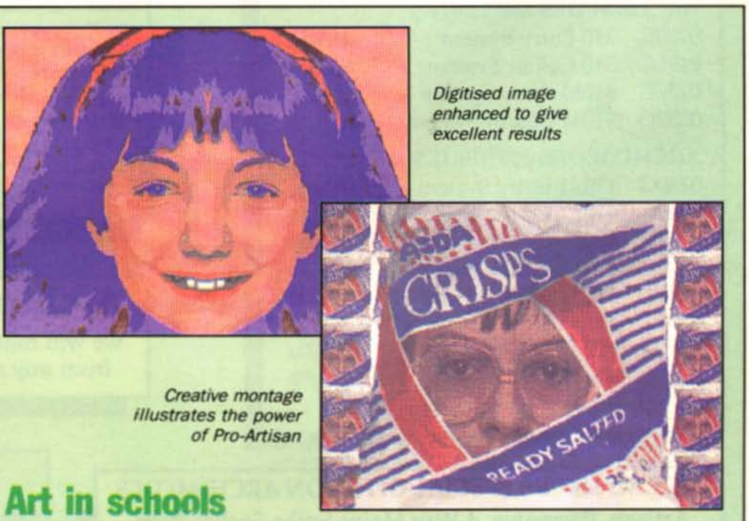
Fractals

Many programs exist to produce stunning fractal displays. Now, they're all replaced on Page 77 with one routine that gives you your own fractal description program. By entering a few simple conditions you can watch amazing pictures build up.

Taking account

We take the audit trail to three accounts packages for the BBC Micro and discover just how useful they can be to you at home or in your business.

If you intend to use your micro for money matters, turn to Page 111.



Digitised image enhanced to give excellent results

Creative montage illustrates the power of Pro-Artisan

Art in schools

In the first of a two part series we begin to explore the power of Pro-Artisan on the Archimedes and its uses in education. Can such a pricey package earn its keep? Is it good value for money? Check it out on Page 52.

MICRO USER CLASSIFIEDS

The best bargains in the world of the BBC Micro come from fellow readers of *The Micro User*. Turn to **Page 130** to find just what you're looking for – from cheap modems to complete computer systems.

✓ **For full details of how to use the Checksums, see the article on Page 48 of the February 1989 issue of *The Micro User*.**

✳ **The Type-it-in symbol indicates that the feature contains at least one full length listing for you to key in on your micro.**

NEXT MONTH

THE MICRO USER

MERRILLS
Ancient game reborn

MUSIC
Studio 24 Plus reviewed

UTILITY
Overlays from sideways ram

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Track changing pages

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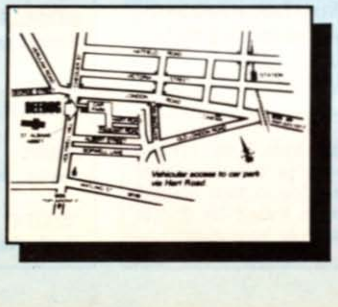

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NEWS*beat*

Mixed reaction to cost-cutting Archimedes

THERE has been a lukewarm trade reaction to the A3000, Acorn's lower cost Archimedes recently launched after months of hints, rumours and denials.

While those in the know think it will be good news for existing Acorn users wanting to upgrade, they feel cost will prevent the new machine making inroads into the Atari or Commodore markets.

At a price of £746 without monitor it will be up against the Atari 1040ST at £499 and the 1Mb Amiga 500 at around £549, both of which include a colour monitor.

David Atherton of Dabs Press said he felt another £150 off the price could have made all the difference and added that while technologically good, the machine is just average in marketing terms.

He feels it will go down well in the education sector. But with just £50 difference in price it could pose a threat to the Master.

Nazir Jessa of Watford Electronics said he felt the machine "filled a gap" for a hi-tech 32 bit Risc machine at a lower price.

Others greeted it with modified rapture as an interesting exercise that will probably satisfy Acorn financially but will not shake the world. The absence of the RS232 port has caused one complaint, as has the siting of the in-built disc drive on the right-hand side of the machine.

The new Archimedes has an ST/Amiga style all-in-one design incorporating a 3.5in floppy drive and two built-in speakers for stereo sound.

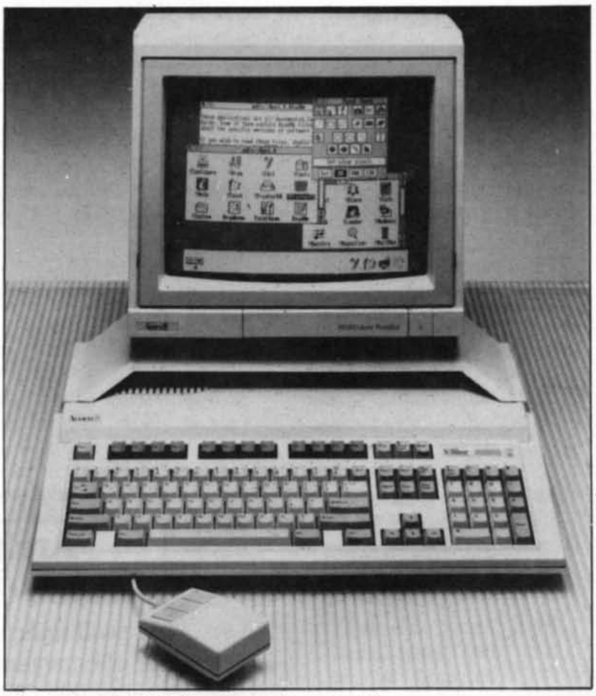
Because of its Risc technology, Acorn are confident the new machine will seriously challenge the dominance of existing computers in the professional and home-user markets.

"We've been showing the A3000 to some key customers and their enthusiasm is extremely encouraging. We are certain it will be a winner and they agree", said Acorn managing director Harvey Coleman who until recently was denying the existence of a low cost Archimedes.

The A3000 has a small footprint with an integral, full enhanced PC keyboard. At its heart is Acorn's 32 bit Risc chip set with 1Mb of fast access ram, expandable to 2Mb.

"This reflects user demands for memory capacity greater than the inherent 640k limita-

Turn to Page 9 ▶



The Archimedes A3000 – Acorn's "new Beeb"

A BBC Micro in the operating theatre

ANAESTHESIA is a precise art and at University Hospital, Nottingham, there are moves to sharpen that precision by taking a BBC Micro into the operating theatre.

Inspired by technical editor Mike Cook's Body Building articles in *The Micro User*, consultant anaesthetist Richard Nickalls plans to connect the machine to syringe drivers and so improve control over drugs given to patients during operations. Senior lecturer at the hospital's adjoining medical school, he hopes to take this even further by using the micro to receive messages from the patient's body, adjust drug output accordingly and even act as a hazard warning for theatre staff.

As well as being put into practice during operations, his ideas will be used for teaching students in the Department of Anaesthesia.

"I am generally interested in looking at micro applications in the operating theatre", he told *The Micro User*. "The first is to link up a micro to drive stepper motors and syringe drives which could get over the inertia problems of the linear motors which are used at present".

MicroProse takes over Rainbird, Firebird

MICROPROSE (0666 54326) has bought Telecomsoft from British Telecom. Under the purchase agreement, Tetbury-based MicroProse control the rights of all brands, existing product stock and new product under development.

MicroProse will retain a London office and a number of Telecomsoft employees will remain. It plans to relaunch and reposition the Rainbird and Firebird labels. A decision on Silverbird has not yet been reached.

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Our non-members prices are normally at least 5% higher.

NEWS beat

Micro joins the ghostbusters

EVEN ghostbusting has become computerised. When things go bump in the night, a BBC Micro has been brought into action to record the paranormal.

Pledged to fight phantoms and see off spirits, a group called The Grimsby Ghostbusters has hit on the idea of using a micro to collect evidence.

When they are called into battle, members of the group install their micro in the afflicted property then leave it overnight to record drops in temperature or variations in light usually associated with ghostly manifestations.

The machine is connected via its analogue port to a thermister which records changes in temperature and to a photo-resistor which senses changes in light levels.

Computer man with the group Robin Mitchell said: "Using the BBC Micro removes the subjectivity. If someone says they feel a chill or notices a change in light levels, all we have is their point of view. The micro is programmed to record and print out any fluctuations so we have evidence on paper of what has actually happened. This gives us objective proof rather than subjective opinion".

Leaving the micro in a haunted property also cuts out the long periods of waiting previously necessary for conscientious ghostbusters.

The Grimsby Ghostbusters started 10 years ago when psychologist Robin Mitchell used his lifelong interest in parapsychology and the supernatural as the basis for a series of night school lectures.

Word got around and others with an interest in hauntings and poltergeists contacted him.

They received an increasing number of calls from people who felt their properties were haunted and although they concentrate mainly on the area around Grimsby, they have dealt with a few cases as far away as London.

Robin started using his micro to help their work two months ago. So far he has had no startling results. Undeterred, he hopes to extend its use to plot electro magnetic fields and static – other phenomena associated with a presence.

Advert angers Acorn

ACORN Computers has complained to the Advertising Standards Authority over a Commodore advertisement comparing the Amiga with the Archimedes.

The Commodore advert claimed the Amiga was "twice the Archimedes for around half the price" and was aimed at schools.

A spokesman for Acorn branded it as blatant miscomparison because it featured the top end Archimedes 440 rather than the 310, which is the machine most used in schools.

"It is rather like shutting the stable door after the horse has bolted, but it is worth it if we get a good judgement at the end of the day", he said.

Commodore had prepared a reply for the ASA, which had not come up with its decision at the time of going to press.

Master 128 for Cyprus centre

SIR Brian Rix, chairman of Mencap and Mental Handicap Services International receives an Acorn Master 128 at a DTI sponsored "Ten Percent Potential" conference in London.

The event was organised to highlight the business opportunities in a market of six million people with disabilities and to encourage companies to take their needs and requirements into account at product design and development stages.

The micro was presented to Sir Brian by Krys Boughey (centre), healthcare specialist at Acorn Computers and was then given to Anna Joannides (right), chairwoman of the Cristos Stelliou Ioannou Foundation.

This centre in Cyprus for adults with learning difficulties which is expanding to become an international training and resource centre for the Middle East.

More kit for the Arc

MACH Technology (0787 238125) has entered the Archimedes market with a wide range of products which is soon to be increased.

Due out is the Floating Point Processor which is compatible with Acorn standards and may be fitted to all Archimedes machines including the A300 series. The processor provides large speed increases for software using the floating point emulator.

Also out soon will be Mach's DTP system, fully featured and compatible with industry standards as well as existing Archimedes software. Price £89.95.

The Mach-286 is a hardware PC emulator claimed to provide complete IBM compatibility and costs £299.95.

Already available are Mach Basic, claimed to be the first production quality Basic compiler for the Archimedes for a price of £39.95, Modula-2, billed as "the epitome of modern structured programming languages" costing £89.95, and HyperBase, database and hypertext system costing £49.95.

◀ ***From Page 7***

tion of MSdos. Peripherals from Acorn and third parties can be added both internally and externally for further expansion", states the launch literature.

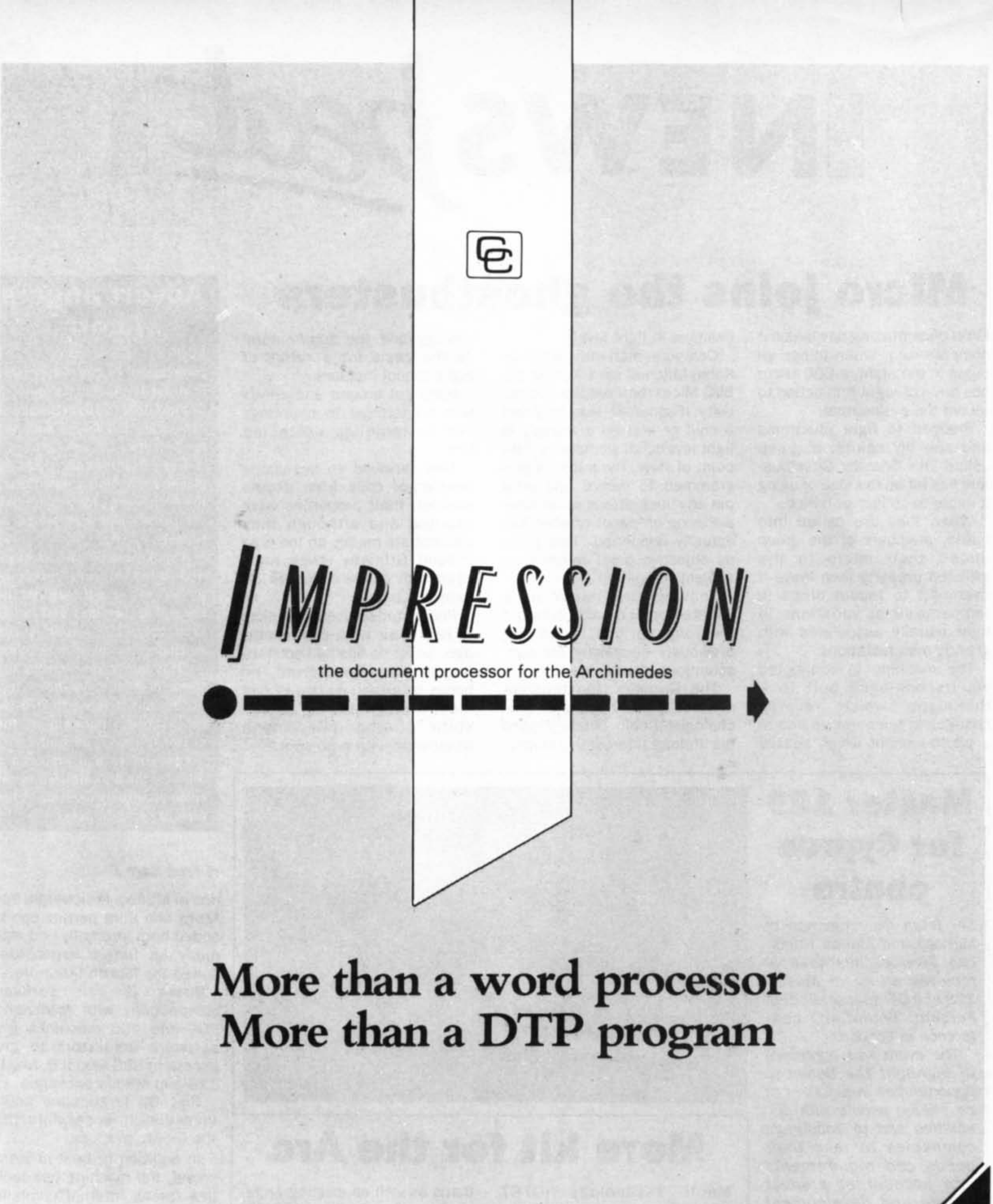
There is full software compatibility with Archimedes 300 and 400 machines plus software emulators to give access to BBC Model B, Master 128 and MSdos packages.

Risc OS is supplied and is immediately accessible from the 0.5Mb of room.

In addition to built-in stereo sound, the machine has facilities for an internal combined Midi and user port card. A second internal expansion slot is provided for an Econet card.

"This ability to move forward in technological terms while keeping faith with software developed over nearly a decade is unprecedented among popular computers", said Coleman. "It is just what users need and once again Acorn is giving Europe a lead in the home and education markets".

● Next month's issue of *The Micro User* will have an in-depth evaluation of the A3000.



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NEWS beat

Arc goes into overdrive

DUE on the market this autumn is a device which it is claimed will increase the speed of the Archimedes by three to five times.

The plug-in upgrade being developed by Aleph One Ltd (0223 811679) enables Acorn's 24MHz Arm-3 Risc processor to directly substitute the existing 8MHz Arm-2 chip fitted to the Archimedes 300, 400 and R140 workstations.

It avoids the problems of fast processor versus standard speed ram memory by using a 2k cache so will be capable of more prolonged full-speed use.

Laurence Van Someren of Aleph explained:"You can turn the extra speed on and off. The default speed of this chip will be 8MHz so that will come up when you switch the machine on. You use the Risc OS icon to switch to high-speed. It will not go on automatically when you power up".

"This has not been taken up by Acorn as an add-on product so we think we have found a niche in the market which we will exploit while they are working on their next machine".

Design work on the new device is now completed, but manufacture could be held up by shortage of the new Arm-3 chips. VLSI Technology in Arizona has been signed up to make the chips for Acorn but have been finding difficulty keeping up with demand.

Lawrence Van Someren sees this as just a temporary setback. VLSI is shortly to open a production line in America's south west which it believes will clear the chip backlog.

Price of the Aleph upgrade will be £595.

Networking conference planned

THE fourth annual networking conference Econet '89 will be held at the Microtechnology Centre, Manchester Polytechnic on September 11 and 12.

It will feature hands-on experience with four rooms fully equipped with Econet systems linking a range of workstations including Master 128, the 32 bit Risc-based Archimedes and the latest R140 Unix workstation.

Sessions will include information for new network managers, advanced network facilities, communications and software development. The latest product developments will be on show at an exhibition which will run throughout the event.

Special seminar and open forum sessions will examine the ways in which networking can enhance the use of information technology in education across the whole curriculum. Workshops will provide practical experience for all levels of network users.

Full details and booking forms are available from Econet '89, Acorn Computers, Fulbourn Road, Cherry Hinton, Cambridge, CB1 4JN.

THE Entertainment Software Publishers Association featured in last month's issue of The Micro User *was officially launched at the recent European Computer Trade Show.*

Pictured at the launch breakfast in the Business Design Centre are freelance independent consultant Simon Treasure who originally conceived the idea of the ESPA, membership secretary of the Software Publishers Association in America, Cheryl Davis and the first chairman of the ESPA, Andrew Hewson of software house Hewsons.

The ESPA has been formed to improve the environment for the games software industry by developing cooperation among competing firms and to help FAST in its fight against software piracy.

Big boost for Small C

MIJAS Software (096 289352) has brought out a code optimiser for Small C which it claims will run programs up to 24 times faster than BBC Basic. "This increase in speed is coupled to a significant reduction in program size", said John Evans of Mijas.

The standard system costs £57.05 and the optimiser £28.75.

Picture: Danjaq S.A.

BOND IS BACK

JAMES Bond is back on the big screen and, courtesy of Domark (01-780 2222) 007, will also be on BBC Micro screens. Licence to Kill, the latest Bond film is being quickly followed by the game of the same name.

In the film, Timothy Dalton portrays a new, tougher Bond waging personal vendetta against drug smuggler Sanchez, and Domark promises that its game closely follows the movie plot.

Players will guide Bond through a helicopter chase, an underwater scene with sharks and a race in a stolen cropduster.

Due out one week after the June premier of the film, BBC Micro versions of Licence to Kill will cost £12.99 for cassette or £14.99 on disc.

Also due out at the end of June is Trivial Pursuit-A New Beginning, another version of the popular board game, on cassette for £9.99, disc £12.99.

Domark has recently released Return of the Jedi completing the trilogy which started with Star Wars and The Empire Strikes Back.

Continuing the battle against rebel forces trying to attack the new Imperial Deathstar, it's another action packed offering. Cassette version £9.99, disc £12.99.

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PROBLEM SOLVED

Interfacing discs

I RECENTLY bought a BBC B and having played around with it I am gaining more interest all the time. I now want to buy a disc drive but I don't know where to start. Could you help me by telling me a good cheap system compatible with mine? Do I need any interface or can I plug the drive straight into my micro? Finally, should I buy a 3.5in or 5.25in drive? – **J.N. Lacey, Gt. Yarmouth, Norfolk.**

● *If you have only recently bought a BBC B it is likely that it is second hand, as they haven't been made for a few years now. Generally you need to fit a disc interface inside your micro before you can attach a disc drive.*

To find if you already have one fitted, take the lid off and look at where it says Acorn on the board. Under this there may be two 40-pin integrated circuits. If one is only a socket you will need to fit a disc interface – you will see several advertised in The Micro User. *I use the Watford double density one and have found it to be good as it gives the choice of using single density as well. With double density you get more programs on your disc, but single density is the standard.*

As far as disc drives are concerned, the standard for the BBC Micro is 5.25in and, although you can fit a smaller size, you would have trouble getting software on that format. I strongly recommend getting a disc drive with its own power supply rather than relying on the micro's supply. They are a little more expensive but the extra reliability is well worth it.

All the BBC Micro drives advertised in The Micro User *are compatible with your needs so scout through the advertisements to find your bargains.*

Archimedes sound

I HAVE an Archimedes 310 system with a standard monitor which I use a great deal for music and sound production, using various software packages. In order to increase the amplitude and overall sound quality I want to connect the 32 ohm stereo output socket on the back of the micro to an amplifier like the one in the monitor. Could you explain what precautions, if any, need to be taken when connecting up an amplifier? – **D.J. White, Torrington.**

● *The sound output can be directly connected to the audio input of the monitor and this will provide an improvement. However, the Archimedes has a stero output and the monitor is only mono, so for best results use an external stereo amplifier and speaker system. As all amplifiers have a much higher impedence than 32 ohms you can connect it up without any trouble.*

Rom clashes

I HAVE installed the Inter-Word rom and the Watford 32k shadow ram expansion board. However I now find that my Mini Office II disc or my disc version of Dial-Up will not work. In addition I am not able to use several disc programs written in Basic.

I have been advised to obtain an external sideways rom socket board to house the Inter-Word so that it can be removed easily when I need to use the other programs. What board would you recommend? – **N. Reed, Huddersfield.**

● *While I have not had any direct experience of this problem, it seems from your letter that either Inter-Word or the expansion board is causing the trouble. First you must find out which is the culprit by removing them one at a time.*

If your expansion board is at fault contact your supplier. If the rom is causing your problem you might find the sideways ZIF – zero insertion force – socket from Watford Electronics just what you are looking for. This will allow you to insert and remove a sideways rom without placing any strain on the pins.

Monitor interference

WHEN I play certain games on my BBC Micro I get a continuous display of vertical bands moving across the screen. They are quite fast at first and then slow down before stopping and moving in the opposite direction. Could you please tell me what can be causing this? – **G.D. Hoy, Chelmsford.**

● *You do not say if you are using a TV set or a monitor. This sounds like some form of interference. If you have a TV set it could be coming from an adjacent TV channel.*

In this case change the output from the modulator by inserting a small screwdriver into the hole in the metal modulator case – attached

Turn to Page 14 ▶

On the agenda...

- **BBC Micro disc interfacing**
- **Preventing software clashes**
- **Sound advice for the Archimedes**
- **Improving the micro display**
- **Repairing broken connections**
- **Using a SCSI hard disc**
- **External micro buttons**
- **Corrupt display on a BBC Micro**

◀ From Page 13

to the UHF output inside the micro – and give it half a turn. Now re-tune your TV: If the problem is worse turn the screwdriver in the other direction.

It could also be interference from your micro, so try re-positioning your equipment. Finally it could be that you have the brightness turned up far too high, so you could try adjusting that and the contrast.

Archimedes hard disc

I have an Archimedes 310 with a four slot backplane. I sold my PC and I now have a spare hard disc, a SQ555 with a SCSI interface and a 44.5Mb removable cartridge. Do I need some kind of interface to connect my hard disc? – **Tony Hopstaken, The Netherlands.**

● *Selling your PC is the best thing you could ever have done with it, but unfortunately at the moment there is no way to fit a SCSI interfaced hard disc to an Archimedes. In the listing of podule types provided by Acorn is a SCSI podule manufactured by Olivetti, but I have no further information about it.*

There might be a possibility of removing the hard drive from your unit and fitting it to a hard disc interface podule like the ones available from Watford Electronics (0923 37774) or Computerware (01-568 8678) but this would mean dismantling your existing unit.

Broken connections

IT all started when I bought an AMX mouse. I had to move the DFS to another socket but when I took it out I left pin 1 behind. So I carefully put the pin in the correct slot in the new socket and made sure it made contact with the chip. This has been OK ever since, but there might be problems if I have to move it again.

More recently I was just brushing some dust off the main board when the negative power lead that connects to the right of the board came off. When I looked closer I found the spade connector had broken. This is now held in place by friction, the law of gravity and an elastic band.

I can't solder either of these connections because the rom would overheat and it is hard to get at the broken spade. So I would be grateful if you could tell me where I can buy some conducting liquid solder with which to repair these.

Also when I move my mouse quickly the pointer moves in the wrong direction. I think this is because the ball is dirty and slippery even though I use it on a mat. How can I clean it? – **A. Stoner, Milton Keynes.**

● *Quite a chapter of accidents! There is no such thing as conducting liquid solder, but all is not lost. Pin 1 on the roms is only used during programming and, although some makes require this pin to be at 5v during read operations, the majority do not. Incidentally, I would be very surprised if you were to make contact with a pin in the way you say.*

Secondly, the earth power lead again is probably not making contact in the way you think it is. Electrically the return current is being taken through one of the other two power leads. Acorn fitted three to help with the even power distribution and power supply decoupling.

It does not follow that losing one lead would cause your micro to stop working, but it could malfunction occasionally. The solution is to extract the spade terminal from the connector using pliers and solder it back on the board.

As to the problem with the mouse, it sounds as if the direction control is getting fooled at high speed – it's nothing to do with the ball slipping. In fact if the ball was slipping you would probably not get the problem.

The ball can be cleaned with a simple soap solution if you remove it first. Otherwise use a cotton wool stick and IPA – isopropyl alchohol.

Corrupt mode changes

I HAVE a BBC Micro issue 3 board and any program that changes the mode occasionally corrupts the screen. For example, when switching to the preview mode in Wordwise, the left hand margin of the display starts two thirds to the right and the right hand part wraps round to the left of the screen.

Toggling between Edit and Preview eventually clears the fault but whenever there is a program running then there is about a one in five chance of it occurring. Also text will sometimes change colour – white going to yellow. When I jiggle the micro lid it returns to black and white. – **G. Arthur, Chelmsford.**

● *First things first. This sounds as if the correct commands are not being latched into the CRT control – IC 2, a MC6845. This chip controls the mapping between memory and display and it could need removing and re-inserting to make a better contact between it and the socket. Alternatively, you might need a new chip or socket.*

Your yellowing text is due to the blue signal being absent and this is most likely due to an intermittent connection in the micro's RGB socket.

External keys

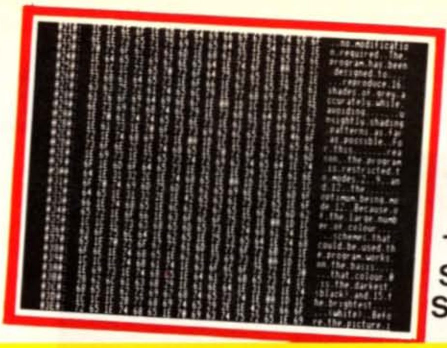
I would like to know how I could attach four buttons, separate from the keyboard, to my Master 128 so that they can emulate any key of my choice. I am not very good at electronics. – **Jasper Smith (14), Oadby, Leicester.**

● *While it is a simple matter to connect extra keys to your micro, getting them to emulate any key is not. I am assuming that you want this for playing games and, unfortunately, different programmers access the keyboard in different ways.*

The most popular way is to bypass the normal keyboard input drivers and directly address the hardware. If this is the case only a key switch wired directly across the key you want to emulate will work. Key switches are less than £1 each.

However, if you want to use an external keypad I did describe how to make one that attaches to the user port in the July 1985 issue of The Micro User. *It used a machine code patch to transfer the key presses into the micro's input buffer.*

The RISC USER ARCHIMEDES TOOLBOX



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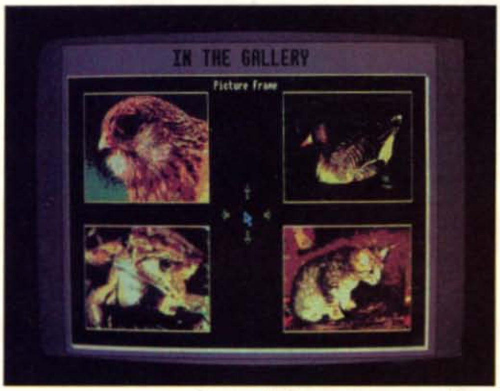
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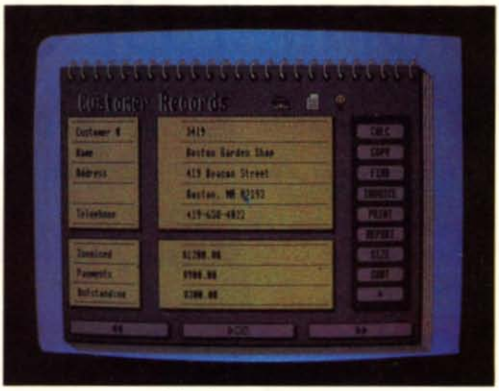
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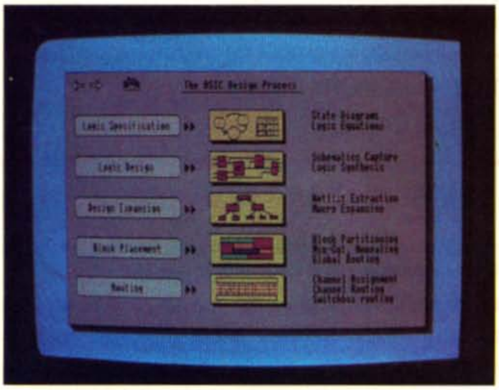

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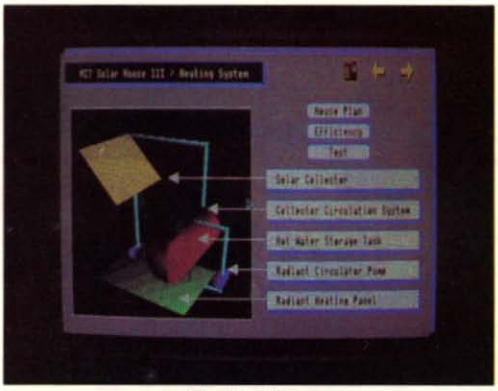

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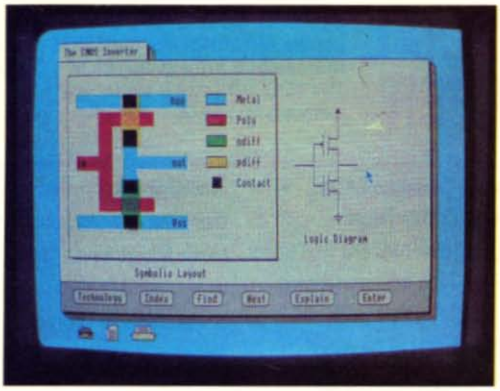
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Symbolic Layout

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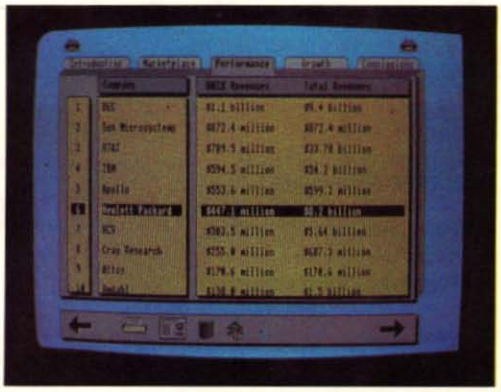

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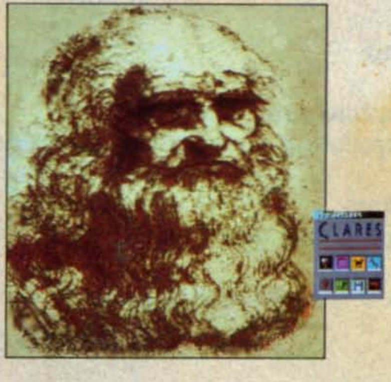
Leonardo Da Vinci (1452 – 1519)

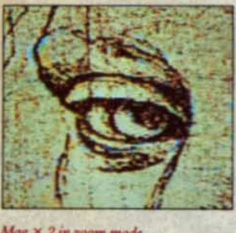


Self Portrait c.1513 drawn in Pro-Artisan c.1989

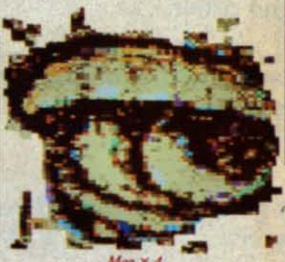
What marvels then, could he have created with modern tools within his grasp?

Like Pro-Artisan from Clares. A computer graphics and image manipulation package which, combined with the Archimedes, produces breathtaking graphics. Bending, shaping, colouring and toning to your every whim.

Eye Detail



Mag × 2 in zoom mode



Mag × 4 illustrating pixelisation

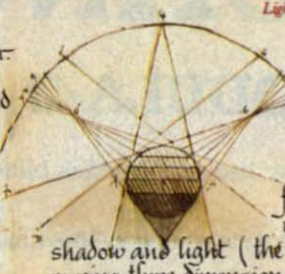
A modern day paintbox.

With which (it may be fair to assume) his self portrait may have looked like the image above, and with Pro-Artisan's zoom facility, he could have created even greater detail.

Da Vinci was indeed a genius.

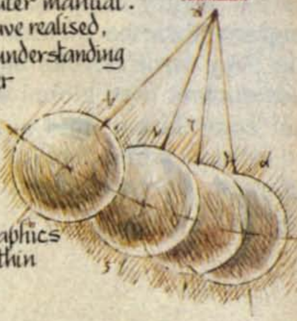
Ahead of his time. A latterday Einstein. Creating wild and wonderful inventions like machines that fly, elaborate ships and submarines.

Light and shadow theory c.1492



Even more mind boggling is his analysis of optical principles. Ray tracing, for example, his understanding of shadow and light (the effect of light moving three dimensional objects) reads like a computer manual.

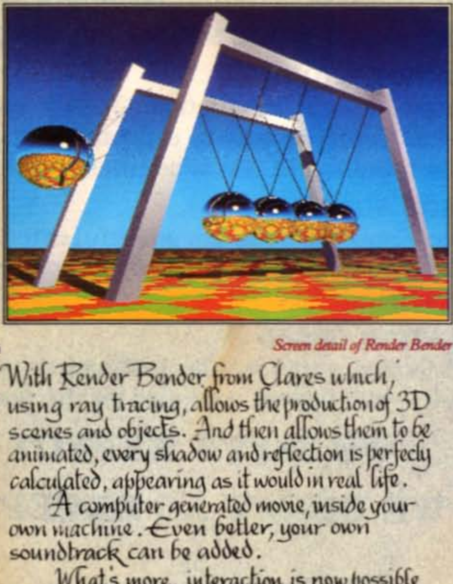
Detail of Delta Animation



He will not have realised, but he had all the understanding of modern computer graphics, without the technology to put it into practice — what frustration.

Today, such graphics manipulation is within everyone's grasp.

Newton's cradle



Screen detail of Render Bender

With Render Bender from Clares which, using ray tracing, allows the production of 3D scenes and objects. And then allows them to be animated, every shadow and reflection is perfecly calculated, appearing as it would in real life.

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What's more, interaction is now possible between Pro-Artisan, Render Bender and Armadeus.

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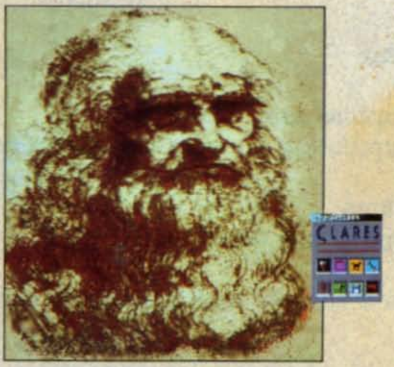
Leonardo Da Vinci (1452 – 1519)



Self Portrait c.1513 drawn in Pro-Artisan c.1989

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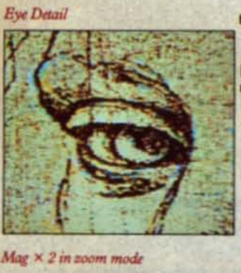
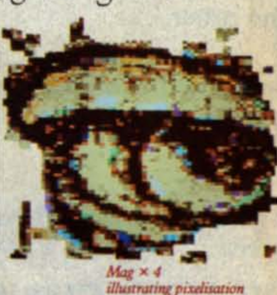


Mag × 2 in zoom mode



Mag × 4 illustrating pixelisation

A modern day paintbox.

With which (it may be fair to assume) his self portrait may have looked like the image above, and with Pro-Artisan's zoom facility, he could have created even greater detail.

Da Vinci was indeed a genius.

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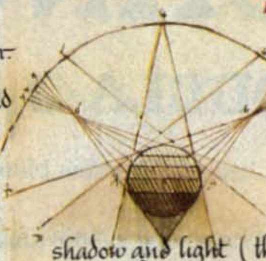
Light and shadow theory c.1492



Even more mind boggling is his analysis of optical principles. Ray tracing, for example, his understanding of shadow and light (the effect of light moving three dimensional objects) reads like a computer manual.

He will not have realised, but he had all the understanding of modern computer graphics, without the technology to put it into practice — what frustration.

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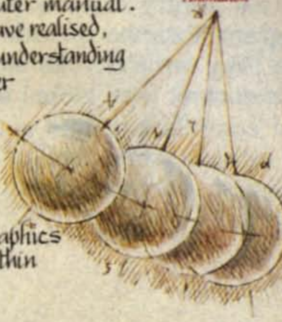
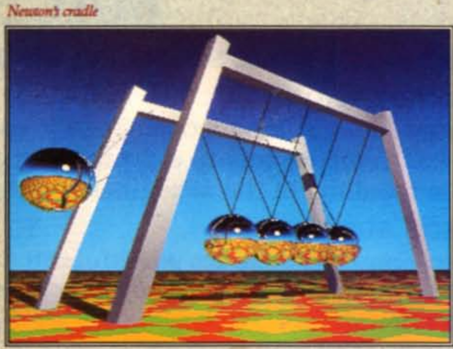
Detail of Delta Animation



Newton's cradle



Screen detail of Render Bender

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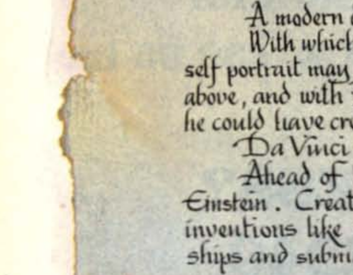

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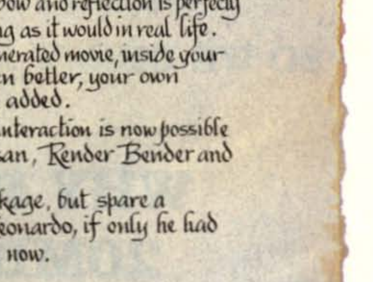

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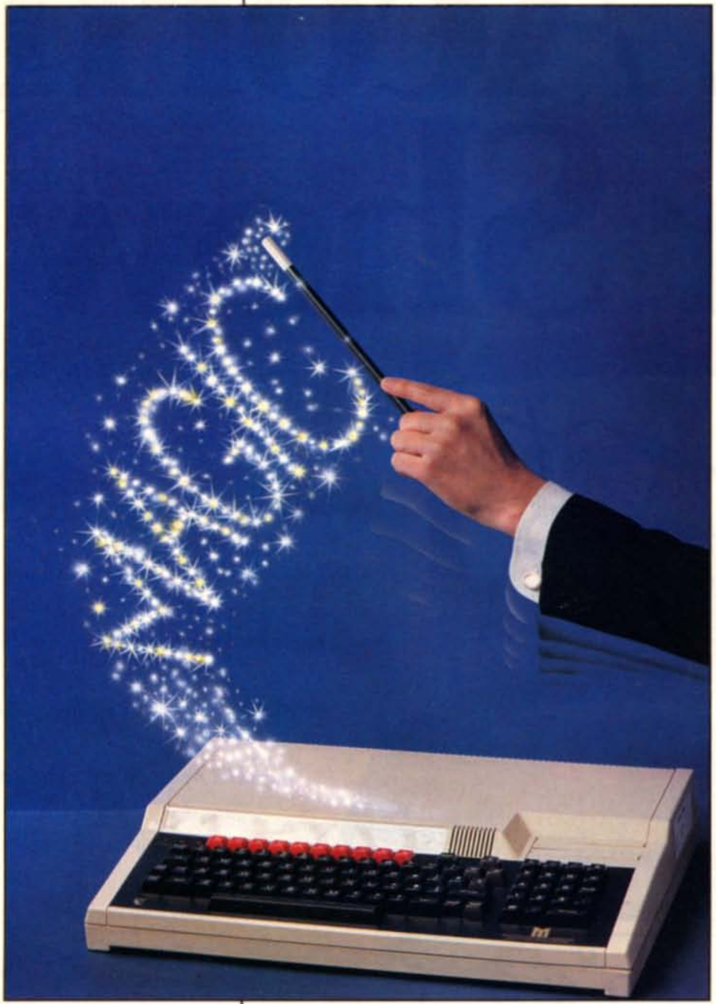

THE BEEB BODY BUILDING COURSE

Words out of thin air

Mike Cook waves a magic wand in the dark

LET'S look this month at a fun project that nevertheless illustrates an important physiological phenomenon. We are going to make a magic wand that can produce messages in thin air. One of the most important properties of the eye, as far as modern technology is concerned, is persistence of vision. Without it there would be no film industry, no television and a very different computer industry. And yet, in a way, it is a shortcoming.

If you look at a flashing light it will only appear to be flashing below a certain critical rate. Anything slower than 32 flashes a second will appear as flickering, while above this it appears to be permanently lit. Your eye cannot respond to such a fast flicker rate so it just gives up and interprets the light as continuous.

This effect is exploited in all sorts of visual systems. At the cinema we do not perceive a sequence of flickering pictures; similarly the television screen appears to shine out continuously. Even an ordinary fluorescent light is flashing 50 times a second, but we perceive it as steady.

However the eye is capable of detecting single flashes at a much shorter time period than a continuous flashing source. You can do a simple experiment to confirm this. Hold out your hand at arm's length in front of natural daylight or a light bulb and waggle it rapidly backwards and forwards. What you will see is a blur of fingers. Now repeat this in front of a TV screen or fluorescent lamp, what you see is not a blur but a number of individual images of your fingers.

True, you appear to have about 10 fingers on your hand, but each has a clear and sharp outline.

This is known as the stroboscopic effect – if you alter the frequency of the flashes to some multiple of the movement of your hand you can stop the image. This is used in the stroboscope to "freeze" fast moving machinery so that it can be studied while in motion. This effect can also be introduced inadvertently – for example, if a lathe were to be illuminated with fluorescent light it could appear at certain speeds to be stationary with disastrous consequences for anyone touching it. That is why there are strict lighting regulations in the Factories Act.

What I want to do is illustrate this phenomenon by making a magic wand. Basically it is a single column of seven light emitting diodes. These, unlike normal light bulbs, can be turned on and off very rapidly because the light is produced directly from the electricity and not from the result of a filament getting hot.

Incidentally the light is produced directly in the LED's colour – it is not filtered white light. The colour is dictated by the sort of material used which is why infra-red and red LEDs are common and cheap. Yellow and green are a little more expensive and blue and white LEDs are extremely expensive – about £35 for a blue one.

What we will do is use the LED's ability to turn on rapidly to generate a message. If we have a column of LEDs we can flash the message one column at a time just as we would create characters on a micro display from a collection of pixels. However, just flashing the LEDs alone will not reveal the message, we need to distribute the flashes in space.

This is done by the simple expedient of physically moving the LEDs, in other words put them on a long stick and wiggle them about.

Wiggling the lights implies that first the movement is in one direction and then the other. In order to have our messsage displayed clearly we must produce the columns in a different order, depending on the current direction of motion.

To perform this synchronising activity we can use a mercury switch of the type used in last month's project. When this is suddenly stopped the momentum of the mercury ensures it sloshes to the other end of the tube. Thus, if wiggled up and down, the switch contact is always made in one direction and broken in the other. This can be used to provide the micro with a synchronising signal.

So the requirements for our wand are to have one input for the mercury switch and outputs for the LEDs. On the user port we can accommodate this input and drive seven LEDs, which are sufficient to make any character. As the user port does not have enough power to drive a LED directly we need to make a simple transistor buffer. The circuit is shown in Figure I – note how the same circuit is repeated seven times.

It can be made on a small piece of Vero board, and for those who are not all that confident of their ability to convert a circuit diagram into a practical layout I have shown you how to do it in Figure II. Note here that for convenience we are looking at the copper strips through the board. The components are pushed in through the plain side of the board and soldered to the copper strips.

The copper strips are broken at various points and this is shown as if we are looking through the board. The best way to break the strips is to use a small tool called a spot face cutter, but at a pinch a sharp hand-held drill will do. Be sure and cut all the track, it is only too easy to leave a small whisker of copper and it is important to make a clean break.

Now we have to connect the circuit to the micro, and we can do this in several ways. Perhaps the simplest is to use the Body Build transition board pack 1. This, together with the cable – pack 2 – allows simple screw connections to be made to the user port. Those of you who have made the Experimenter's Board – *The Micro User* August 1988 to May 1989 – can use that.

If so, use the outputs on the A side (printer port) of the VIA to drive the LEDs and the B side for the mercury switch. This will require a simple modification to the software, but more of that later. At a pinch you could use the experimenter's LED bar display, but that would mean wiggling the large board at a rate of knots which could be difficult due to its weight.

Having connected the LEDs to the micro, mount them on the end of a stick about 60cm long as shown in Figure III. I did this with sticky-backed foam pads. Now we are ready to write the

Turn to Page 25 ►

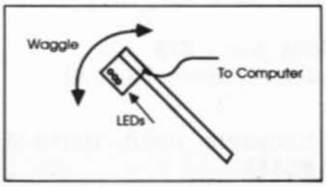

Figure III: On a stick – the LED board

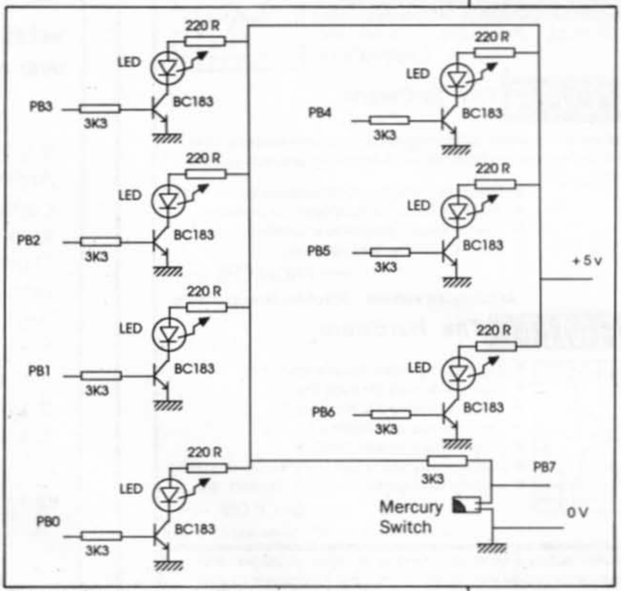

Figure I: Circuit diagram of the Magic Wand

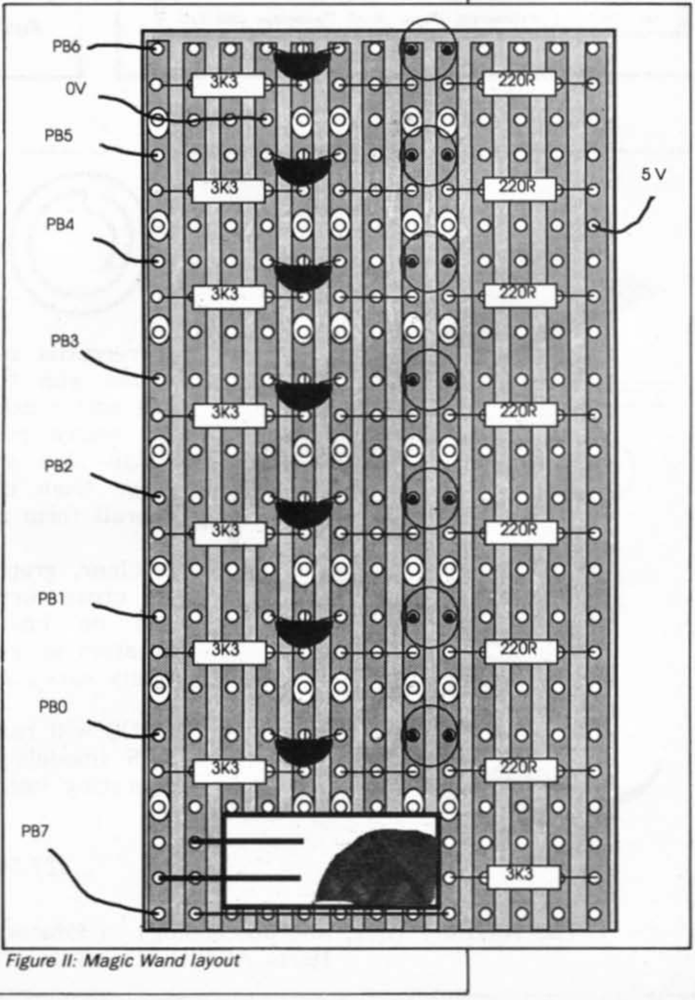

Figure II: Magic Wand layout

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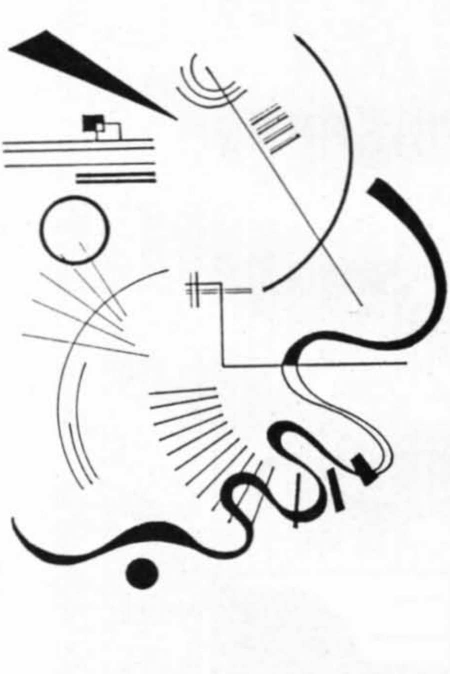

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```
   10 REM Magic wand By Mike Cook
   20 DIM MS% 8*20
   30 ?&FE62=&7F
   40 REPEAT
   50 MODE4
   60 PRINTTAB(0,4);"Magic Wand"
   70 PRINT"Beeb Body Building Course"
   80 PRINT"July 1989"
   90 PRINT"By Mike Cook"
  100 PRINTTAB(0,9);"Test or Message (T/
M) ";
  110 A$=GET$
  120 PRINTA$:PRINT
  130 IF A$="M" OR A$="m" PROC_MESSAGE
  140 IF A$="T" OR A$="T" PROC_TEST
  150 UNTIL FALSE
  160 DEF PROC_TEST
  170 PRINT"Press Space bar to end"
  180 A%=1
  190 REPEAT
  200 ?&FE60=A%
  210 A%=A%*2
  220 IF A%>128 THEN A%=1
  230 B%=?&FE60
  240 PRINTTAB(0,16);"Mecury switch is "
;
  250 IF B% AND &80 PRINT"RIGHT" ELSE PR
INT"LEFT "
  260 FOR B%=0 TO 255:NEXT
  270 UNTIL INKEY(-99)
  280 ?&FE60=0
  290 ENDPROC
  300 DEF PROC_MESSAGE
  310 P%=MS%
  320 INPUT"Type in your message "M$
  330 M$="  "+M$+"  "
  340 IF LEN(M$)>20 PRINT"Too long ":GOT
0 320
  350 GCOL 3,1
  360 PRINTTAB(0,24);M$
  370 FOR X%=0 TO 32*LEN(M$) STEP 4
  380 S%=1
  390 B%=0
  400 FOR Y%=224 TO 256 STEP 4
  410 T%=POINT(X%,Y%)
  420 B%=B% OR ((S% DIV 2)*T%)
  430 S%=S%*2
  440 PLOT 69,X%,Y%
  450 NEXT
  460 ?P%=B%
  470 P%=P%+1
  480 NEXT
  490 L%=LEN(M$)*8
  500 PRINTTAB(0,28);"Start waggling"
  510 PRINT"Space Bar to end"
  520 REPEAT
  530 REPEAT:UNTIL ?&FE60>&7F
  540 FOR P%=L% TO 0 STEP -1
  550 FOR B%=0 TO 2:NEXT
  560 ?&FE60=MS%?P%
  570 NEXT
  580 REPEAT:UNTIL ?&FE60<&80
  590 FOR P%=0 TO L%
  600 FOR B%=0 TO 2:NEXT
  610 ?&FE60=MS%?P%
  620 NEXT
  630 UNTIL INKEY(-99)
  640 ENDPROC
```

Get it right!

```
 10 =    0 0
 20 = CD25 5
 30 = AB07 2
 40 = BFBA 9
 50 = BA9F 2
 60 = 8A3A A
 70 = CCB2 D
 80 = B5C3 C
 90 = FC23 B
100 = 1F9C 8
110 = 77F2 8
120 = C249 9
130 = 8613 B
140 = 7CD0 2
150 = 226C A
160 = 6C4A 6
170 = 3A16 4
180 = 20A5 F
190 = BFBA 3
200 = E261 6
210 = B432 6
220 = E441 0
230 = 1069 F
240 = 6DAA 6
250 = 8D21 D
260 = 7749 7
270 = 4CF5 5
280 =  E4C 6
290 = ED0F 0
300 = E730 E
310 = 3ECF 1
320 = E41A 3
330 = A163 5
340 = 65E2 0
350 = 38CB C
360 = B1A4 0
370 = A8A0 5
380 = D66A 2
390 = AB58 2
400 = 7C47 D
410 = DB0B 3
420 = 94CE A
430 = 1565 A
440 = B9A7 D
450 = 2C83 0
460 = EC2B A
470 = 5569 D
480 = 2C83 E
490 =  8E9 6
500 = 2D87 8
510 = BAF3 5
520 = BFBA 8
530 = FE47 3
540 = F422 1
550 = C07C 4
560 =  6DE 2
570 = 2C83 9
580 = 1D40 F
590 = 430E 0
600 = C07C 4
610 =  6DE A
620 = 2C83 B
630 = 4CF5 3
640 = ED0F A
```

◀ *From Page 23*

software. Basically, the information required to drive the LEDs is the same as that needed to plot a character on the screen, so the strategy is simple. First print the message on the screen, then look at each point around the message to see if it is on or off and gather this in a suitable form in memory.

Next output this information either forwards or backwards, depending on the state of the mercury switch. This is shown in the listing, and it also serves as a test program.

When run, you are asked whether this is a test or not. If you press *T* all the LEDs will flash in turn from the bottom of the column upwards. Also the state of the mercury switch will be indicated as left and right – make sure you type in the space at the end of LEFT in line 250. When you are satisfied that the wand is working you can press the spacebar and indicate you want to type in a message. The maximum message length is 20 characters but you will get best results by using a short word.

Two space characters are inserted at the start and end of the message to allow for the time taken for the wand to change direction. Then the message is printed out on the screen and scanned. While it is doing this, each pixel is inverted so you can see the progress. Then a message appears for you to start waving your wand and, as if by magic, your message appears out of thin air in front of you.

Every time the mercury switch is tipped the message is output once. The program then pauses until the mercury switch indicates the lights are making a return journey. Basic is just fast enough to cope with this without us having to resort to machine code.

You will find the results much better in a darkened room, as the LEDs stand out a little more clearly. With a bit of practice you will soon find the optimum speed and extent of waving – occasionally the system can get out of synchronisation and the message will appear back to front.

If you are using the Experimenter's Board you must change line 30 to read 0 instead of &7F and in lines 200, 560 and 610 replace FE60 with FE61.

If you remove lines 540 to 570 the message will only be output during one swing of the wand. This might be an improvement for long messages because it stops it getting out of synchronisation between the two directions of movement. Best are palindromic words like MUM.

Well there you have it, Mike Cook's Magic Wand, I don't think Paul Daniels will have many sleepless nights! See you next month.

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Premier's pre-release has already created quite a stir and demand is increasing, so act now. Write or phone for full details, a refundable demo disc, or the full version of this exciting new product. Price including 160 page manual, word processor application, key strips, and free updates during 1989, £96 + VAT, post free.

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ONE problem area in desktop publishing lies in the inclusion of pictures. No matter how much textual work or line drawings you can produce with the software you still need to *paste* photographs or other work into spaces left for them. The answer is a scanner, a handy device that let's you convert a picture into a digital representation that can be held in a micro.

Previously no one had produced a commercially available scanner for any of Acorn's machines but now the situation has changed with the arrival of Scan-Light from Computer Concepts.

The package consists of the scanning unit itself, an expansion card with picture grabbing circuitry and a 48-page manual. Fitting the card is simple, but you'll need a backplane with a spare socket. The scanner is at the end of a metre of cable which is sufficient but you'll also need a nice flat surface to work on.

The system installs itself automatically as a rom module at switch on and puts up its name in the start up sequence. Entering *SCAN runs the software – it will grab up to 560k of ram – and it multitasks perfectly with the rest of the system.

My only niggle here is that to conform with Risc OS it should be on the icon bar right from start up, and only grab memory when you click its icon with Select. In a Wimp environment you shouldn't need to type *SCAN*.

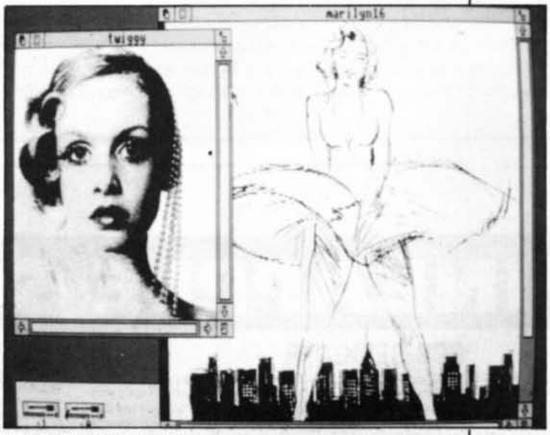
When activated, a window filled with the currently scanned image appears – none at all to start with. A menu bar also appears with File, Scan and Edit options. It can be dragged around the screen to your preferred position. This, again, is a bit non-standard, but you can bring up a menu as normal by clicking the Menu button while over the scanner window.

The next step is to scan an image. You click Menu, select Scan and now have the choice of cancelling the operation, continue using a text option or choosing picture then scanning. The decision between text or picture is simply that printed words and line graphics come out better with the former, and photographs or shaded images are improved using the latter.

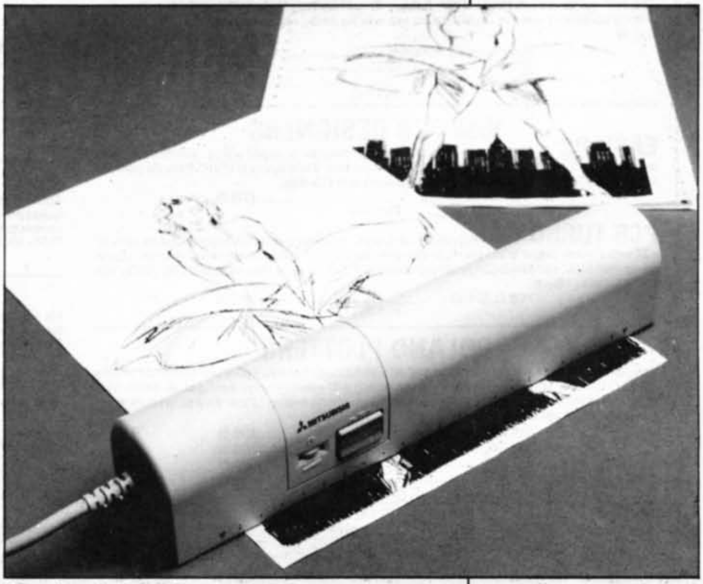
The process of scanning, is simple as long as you follow some basic rules – the paper must be flat, the scanner lined up so each scan line is horizontal, and – most importantly – you must perform the scan slowly. The manual says 10 to 15 seconds to cover an A4 sheet, but that really is as fast as you dare go – if you go too fast whole lines get missed out. Unfortunately scanning ceases if you stop moving the unit, so you can't go too slow either.

The unit can't recognise reds as distinct from

Turn to Page 28 ▶



Using 16 levels of grey



Scanning an original masterpiece

◄ From Page 27

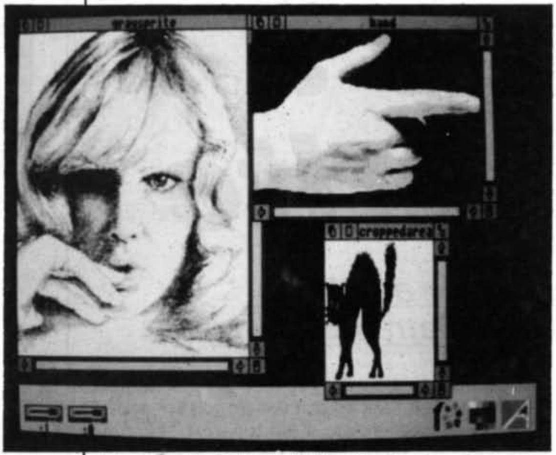
white because it uses a red light – which means that colour pictures are less than accurate.

The Scan-Light software provides utilities for pixel editing and saving portions of the screen. However I found it was much easier to save the area I wanted as a sprite and then load it into the Risc OS sprite editor. This has a lot more facilities, including the ability to flip and rotate which are sometimes necessary when the direction you scan is dictated by folds, bends or the shape of the image.

There are a number of other options like the ability to add sprites to the image, either scaled or clipped to a particular box size. You can save as a FaxFile – for compatibility with Computer Concepts' fax equipment – or load them and so on.

Certain security problems present themselves when it comes to the use of fax. It is possible to scan a signature and then add it to a document which can then be printed. While this might be obvious if done on a stand alone machine, it can become serious if such a document is then transmitted as a fax image. Companies are going to have to insist on *snail mail* confirmation – electronic counterparts can be manipulated too easily.

Scan-Light is certainly an impressive piece of equipment: It works a treat and it will enhance any DTP package.



Some scanned demonstration images

Summing up

While it's not the sort of thing you'd use every day, if you're going to be doing DTP on an Archimedes you need a scanner and this – at the moment – is the only one. It is very easy to use and getting from a paper image to a finished trimmed and tidied sprite takes just a few minutes.

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'The quality of printing is the last factor which makes Diagram II so outstanding. The package really is capable of producing top quality diagrams.'–ETI, March '88

Diagram II .... £55.00 P&P Free

ADFS Utilities Rom

ADU is an invaluable utility for all ADFS users. It adds over 22 new *commands to the ADFS filing system as well as providing an extensive Menu facility with over 35 sub commands covering areas such as repeated disc compaction, saving and loading Rom images, auto booting of files and many more. Transferring of files from DFS to ADFS is also made very easy with *DFSADFS.

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Access

er Super scroller Su

Terry Blunt gives your micro big output capabilities

HERE is an enhancement of the text scroller published in the June 1988 Library. The original took its text from data statements and scrolled them smoothly with large characters. A number of special effects were also included like pause and flash. As this new program works from any Ascii file there is no longer a memory constraint on the amount of text.

In fact a 50k file has been run quite successfully at a handicrafts exhibition. When the scroller reaches the end it automatically re-starts, so the display was started in the morning and left to run all day.

There are very few constraints on the text used, although it must be called *file*. Any character values lower than 32 are treated by the scroller as if they were spaces.

In order to change colours, text size and position, an escape sequence within the text consisting of the | character followed by three digits is used – these are detailed in the accompanying panel. All other byte values are treated as legal text so if your word processor can produce the values 128 to 255 you could have user-defined characters too.

If the program were simply to get characters from file and send them straight to the display routine, the display would be jerky and uneven, due to the varying time taken to get bytes from the filing system. This is particularly noticeable on sector boundaries and with the ADFS.

The problem is overcome by maintaining a small 24 byte circular buffer which is continuously fed by the filing system. The vertical sync event is used to take characters from the buffer as they are needed and enter the display routine every fiftieth of a second.

As a lot of processing is done in the display routine and events must execute as quickly as possible, this has been re-written so that there are the minimum of subroutine jumps and it doesn't use indirect addressing, which unfortunately makes it harder to understand.

So key in the listing, ensure there are no typing errors using the checksums, and save it. Enter your word processor and create some text saving it as *file*. If you are using Inter-Word set the left margin to zero, switch off the paging and create the display file using the spool option. Now just CHAIN"scroll" to see the display.

Solid colour values

Code	Colour
00	black
03	red
0C	green
0F	yellow
30	blue
33	magenta
3C	cyan
3F	white

Sideways scroll effects

Control codes are in the form | xyy, where x is the code type from 0 to 6 and yy is the two digit hexadecimal code value.

Code	Meaning
0	Top border colour
1	Text background colour
2	Text foreground colour
3	Bottom border colour
4	Top border height
5	Text height
6	Text width

Out of range codes are ignored. If you wish to actually print the | character instead of using it to mark control codes put two of them together. | | produces | as its output.

the runni

```
   10 REM Sideways Scroll
   20 REM by Terry Blunt
   30 REM (c) The Micro User
   40 IF TOP>&2D80 PRINT"Insuf
ficient memory space":END
   50 LOMEM=&3000
   60 entry=&2D80
   70 mode=2
   80 eventv=&220
   90 himem=&34E
  100 robyte=&352
  110 scbyte=&354
  120 osfind=&FFCE
  130 osbget=&FFD7
  140 oswrch=&FFEE
  150 osword=&FFF1
  160 osbyte=&FFF4
  170 viaddr=&FE00
  180 vidata=&FE01
  190 PROCasm
  200 CALL entry
  210 *FX13 4
  220 MODE7
  230 CLOSE#0
  240 END
  250 :
  260 DEFPROCasm
  270 size=0
  280 FORI%=0 TO2 STEP2
  290 P%=entry
  300 [OPTI%
  310 LDA#13
```

Turn to Page 133 ▶

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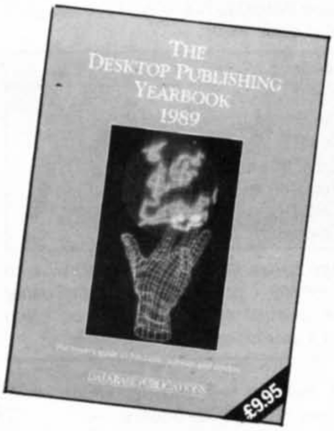

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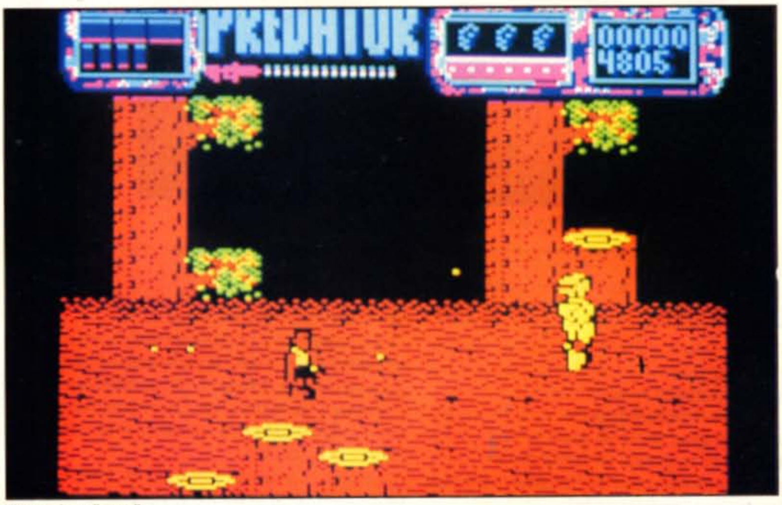
MU7

SOFTWARE SCENE

Predator ... alien attack

Price: £11.95 (5.25in disc), £14.95 (3.5in disc) £9.95 (cassette)
Supplier: Superior Software, Regent House, Skinner Lane, Leeds LS7 1AX.
Tel: 0532 459453.



You can shoot diagonally

PREDATOR has the distinction of being the only Schwarzenegger film I haven't seen, so I can't make any comparisons, but the plot involves an alien which is hunting Arnold and his pals for fun and killing them in unpleasant ways.

I'm reliably informed that during the film the times when you see through the alien's eyes the whole world turns blue. This also happens in the game and until I was told I wondered what was going on.

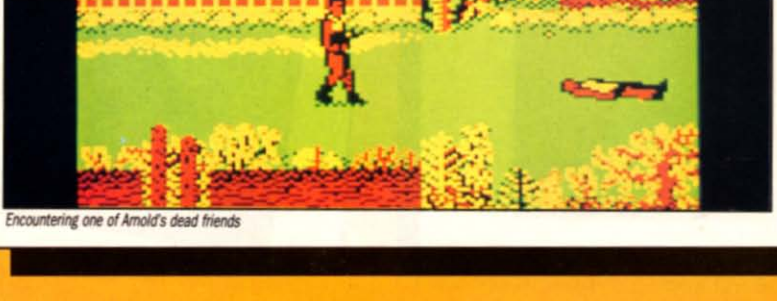
Basically what we have is a sideways shoot-'em-up with Schwarzenegger in the starring role. You move our hero from left to right past parallax scrolling scenery – the bushes in the foreground move faster than the trees at the back – and shoot soldiers coming in from the other direction or hiding in the ground.

The basic controls are standard Z or X for left and right plus * to jump and ? to crouch. But there's more: Holding down the direction controls and pressing * or ? moves the whole figure diagonally up and down the screen. Pressing Return fires Arnold's gun either forwards or diagonally, again dependent on the up and down keys. This gives you a great deal of control over what is, essentially, a simple game.

You can drop the gun you're using and pick up a new one, but so far I've not come across one that's loaded. If you're not carrying a gun you can resort to punches and kicks in true Conan-style, but that doesn't work too well against gun-slinging soldiers. Your final weapons are three grenades. I didn't use them because you have to be very accurate and in this time-limited game it's not worth the effort. The other usual controls are there: Sound on/off, pause and restart.

The soldiers are quite stupid and you have to actually get in their way before they shoot you. And, at long last, if they get in each other's way their bullets have a similar effect on their pals. I've been waiting a long time for a game that does that.

Some soldiers pop out of the ground, fire and then duck down again – must be in trenches – but as long as you hit the right area you can knock them out even if they're not visible.



Encountering one of Arnold's dead friends

However the birds that fly across from time to time are more lethal – these geese are best avoided. Of the three or four groups that appear on the first level most can be dodged while one or two can be, ahem, ducked.

At intervals the screen turns blue and the sights of the alien's weapon slowly move across the screen towards you. One hit and you're dead. There is a way to escape – but let's not spoil your fun.

The graphics are quite effective given the limitations of the four-colour Mode 5 screen. Apart from a preponderance of green – what do you expect in the jungle – everything was clearly outlined and looked good. Not only that, but when our hero was hiding behind a bush or running behind a foreground mesh you still see him through the gaps.

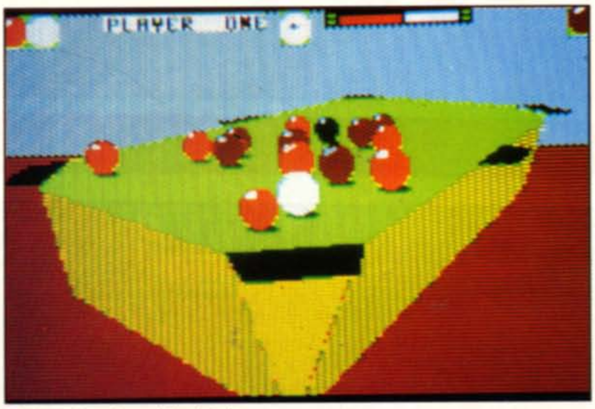
Sound? Gun shots, a noise to indicate Scharzenegger has been hit, another for the alien and an end of game tune that really wasn't worth the effort. However, as this was a pre-release version it may improve.

All in all this is a fun game having a lot of the feel of a Schwarzenegger film – loadsaviolence – and the fact that this is another Peter Scott work, coming hard on the heels of Barbarian II, guarantees that it's as good a rendition on the BBC Micro as could be achieved.

Lazarus

Sound	***5***
Graphics	***9***
Playability	***9***
Value for money	***9***
Overall	***8***

3D Pool ... stimulating simulation



Potting angle can be carefully selected

Price: £8.99 (tape)
Supplier: Firebird, 74 New Oxford Street, London WC1A 1PS.
Tel: 01-631 5206.

FIREBIRD's 3D Pool simulation effectively ties up this section of the market forever – there can never be a program to rival this masterpiece from the pen of Orlando.

A 3D effect is a marketing ploy often used to try and sell a substandard game. But the 3D views created by this Pool simulation are no gimmick. For the first time ever you can walk around the table, take a look from above, or even squat down and sight through the cue ball.

Aiming is achieved by rotating the table until you have obtained the correct impact angle with the object ball – the cue ball always moves in a vertical line up the screen. By altering the height at which you are currently viewing the table you can apply top or back spin to the cue ball.

Collision calculations are worked out to perfection. If, like me, you take great joy in potting balls from impossible angles by cheekily bouncing your own ball off one or more of your opponent's you'll be pleased to know that these shots can be executed with pinpoint accuracy.

We have now established that 3D Pool is a stunning simulation, but does Firebird put it to good use? The answer once again is a resounding yes – all possible game variations have been explored and implemented. The main game is a tournament involving you and seven other players. If you are an exceptionally good player you may just stand a chance of winning this tournament and earn the right to meet "Maltese" Joe Barbara in a special challenge match.

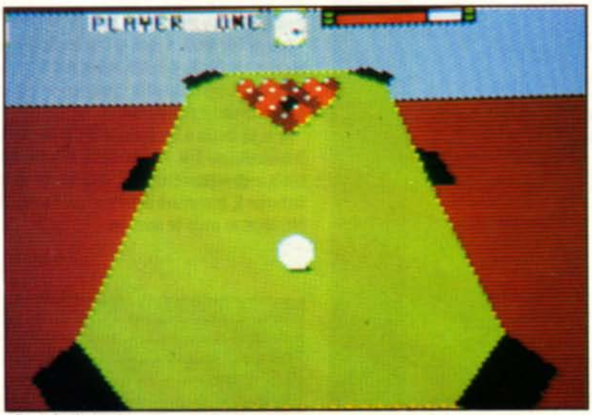
A poor performance in the tournament could be a result of insufficient practice – or skill – so why not select the practice option and tackle one of the seven micro-controlled players? Alternatively, a few minutes watching the machine challenge itself in a demo match can often provide tips on how certain shots should be played.

If you want to amaze your friends you can show off by performing one of the 10 pre-defined trick shots. Or better still take them on man-to-man using the two player option.

Pool players may be interested to know that the game plays the *Free Table* rule for the first shot following a foul and does not carry on the free shot if you pot a ball. 3D Pool is quite simply the most addictive game on the market today – you have been warned.

Jon Revis

Sound	*7*
Graphics	*10*
Playability	*10*
Value for money	*10*
Overall	*9*



Ready for the break

Thundermonk ... fight

Price: £14.95
Supplier: Minerva Software, 69a Sidwell Street, Exeter EX4 6PH.
Tel: 0392 437756.

DIVING straight into the game reveals a full screen display of the Repton variety – it's OK, don't hide yet – with a status screen across the top. Your character is a hooded monk who moves through the maze, which scrolls beautifully, trying to get through various puzzles. Unlike Repton he does have some offensive power.

You begin with 999 points of power plus the ability to throw fireballs but this uses lots of power. You can take many items just by moving over them to add to your score. Some – like bunches of grapes – boost your power and the ball lightning puts you back to max, so shouldn't be wasted.

Difficulties include most greenery which drain power if you touch it and various rotating objects – I can't imagine what they're supposed to be – which are equally lethal. Then there are puzzles on a simple level. Most passages are blocked and, as you can only throw fireballs left and right, you can only remove them by shooting through walls.

Keys lying around are needed to open doors – but some doors require two keys so it's very easy to half open a door and then find you need the key somewhere else. So there is

Stormcycle ... amiable

Price: £1.99 (tape)
Supplier: Atlantis Software, 28 Station Road, London SE25 5AG.
Tel: 01-771 8642.

STORMCYCLE is an arcade adventure based around your attempts to find five light-refracting diodes which are

ELECTRON/BBC
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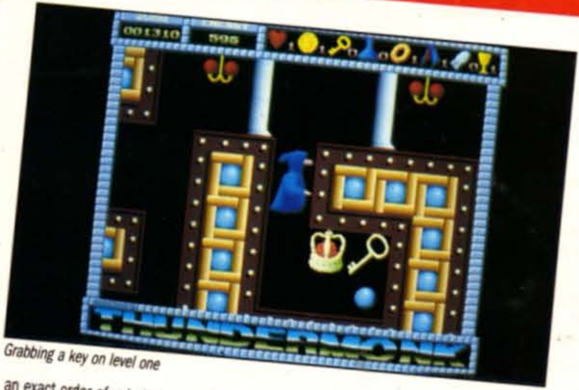
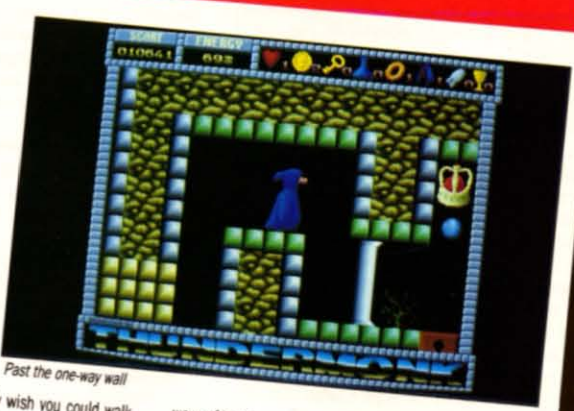
for the right



Grabbing a key on level one



Past the one-way wall

an exact order of solution.

The first level is fairly straightforward, the only tricky bit lies in getting the keys right – but the second level is horrendous. It lulls you into a false sense of security with a simple little puzzle to start. Then hits you with a one-way wall – knock out the barriers first or you get stuck very quickly – and when you've done that there's nowhere else to go.

You can see lot's more of the maze at the edges of the screen but there's no way to get to it – and your energy is clicking down all the time. You really wish you could walk through walls – and that's a hint.

The sound is digitised and very good, full of *yeahs, greats, phoomms*. As for the sheep – believe me you'll come to hate them.

Thundermonk is interesting and fairly enjoyable but I wouldn't say it had me rushing back for more. Like most of Minerva's games it is competently programmed, has impressive graphics but ultimately the gameplay inspired a wave of indifference. The Archimedes is an exciting machine – when are we going to have games to match?

Teri Paul

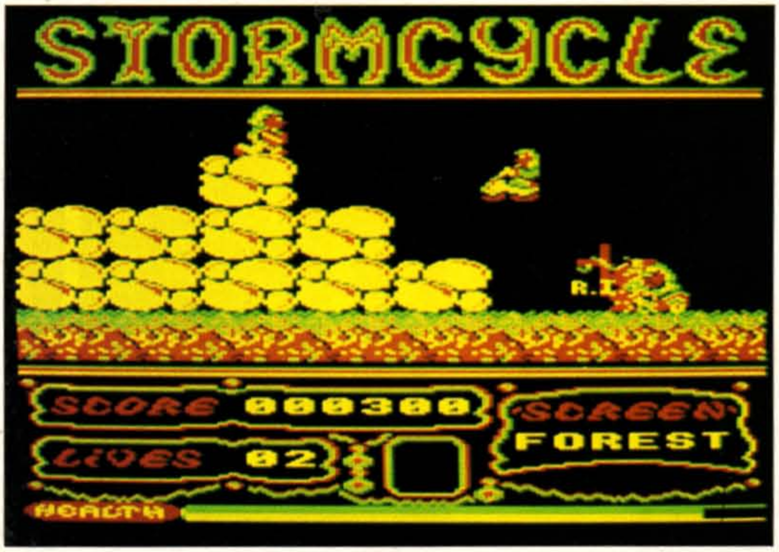
Sound	
Graphics	*9*
Playability	*9*
Value for money	*7*
Overall	*7*
	8

arcade adventure

urgently needed to complete a super laser to protect the Earth from a meteor storm unleashed by alien warmongers.

You wander around the garden outside a house where the diodes must be gathered together. You quickly find that you are not alone. Strange beings drive vehicles along the ground and overhead and contact with them reduces your energy. Flying devils drop bombs which have the same effect. You are armed with a trusty sword which will need to keep lunging all the time or your strength will soon waste away.

The worst hazards are the pits. Fall into one and a whole life is lost – it's just as well you've got three. Assuming you avoid these pitfalls you'll be able to use the energy bottles which are scattered about to recharge yourself. You may also be able to use a smart bomb to destroy all aliens on your current screen, but they seem to have remarkable powers of regeneration.



Movement between the various sections of this game – garden, forest, moon, cellar and castle – is by means of transporters which look like fat little pharaohs, each of which will take you to another area. Many lead to dead ends where your only option is to use the suicide key.

The diodes can be spotted without difficulty, but this doesn't mean they're easy to get at. It takes a bit of practice to become proficient at collecting some of them and one even requires a jump into nothing where you vanish behind the title bar at the top of the screen. There's a little bug here – if you jump you can reappear temporarily at the bottom of the game screen.

One other possible bug – or is it a feature? – is that on one screen you can become walled up in the castle. If this happens it is 100 per cent fatal, but you can avoid this fate as there is no need to visit that location.

Stormcycle is a good game though not in the same league as Citadel, so ordinary mortals like me can complete it and read the boring congratulations screen. The graphics are suitable for a budget game, the animation is fast and it has sensible features like sound on/off and pause. In fact, Stormcycle makes an ideal starter for arcade adventuring.

Rog Frost

Graphics	*8*
Sound	*7*
Playability	*9*
Value for money	*10*
Overall	*9*

Play it Again Sam 8 ... bargain basement

PLAY IT AGAIN SAM 8
SUPERIOR SOFTWARE
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Supplier: Superior Software, Regent House, Skinner Lane, Leeds LS7 1AX.
Tel: 0532 459453.

WINTER Olympiad 88 was a big hit when it was released last year by Tynesoft. A maximum of four players can play – or the micro can take the part of up to three – in a struggle to win as many medals as possible. In all of the simulations you can take part in three heats, your best result being compared against those of the other three competitors.

In all but two events – Bob Sled and Ski Jump – you can abort the second and/or third heats. After each event is completed the medals are awarded and a medals table is displayed before you go on.

The graphics in all six events are excellent: They move smoothly and are usually accompanied by simple, but good quality sound effects. Between events, you are treated to a fairly pleasant version of the theme music to the BBC Television programme Ski Sunday.

In **Bob Sled** you have to drive a two-man bob down a twisting course. The time you take on each run is determined by your skill and judgement in negotiating corners. The faster you are moving on the bends, the further up the side of the run your sled is forced and, if you don't use your brakes enough, you fall out. If you go to the other extreme and use the brakes too much, your time will be slow. A bird's eye view of the course showing your position, is displayed in a window on the right.

Next comes **Speed Skating** where you simply have to provide the energy to drive your skater once around a large rink. You do so by hitting two keys alternately to make the skater pick up speed. Unlike other key-hitting exercises it is timing that counts, not speed. If you have a good sense of rhythm you'll win this one easily.

Ski Jump brings out the Eddie the Eagle in you. The event starts off with a rear view of your man waiting at the top of the hill. Once the tone indicates it is time to start your jump, hit Z and X alternately to get up a good speed.

Once you have got going a side-on view of the jump is displayed and you must continue to hammer the keys to increase speed. Finally, you are given a close-up view of your jumper as he travels through the air. Use C and F to keep his skis aligned. If you do well you're rewarded with his perfect landing; otherwise it's an ignominious rear-ender.

The **Giant Slalom** gives a diagonal view of a skier moving downhill and the Z and X keys are used to make him weave in and out of suspended poles. It's not too taxing but I've never managed a clear descent.

For me **Ski Slalom** is one of the better events. You are given a view from behind the skier and as he descends you have to guide him between pairs of poles. Sounds easy? Well, some of them are off the screen and a little arrow shows which way you have to go.

But the best is last. **Biathlon** is a fascinating sport involving long distance skiing interspersed with rifle marksmanship. Moving the skier between target ranges involves rhythmic key pounding – if you get out of synchronisation you lose speed rapidly.

The shooting is simple, the cassette interface relay clicks to indicate the rifle being cocked – a neat trick – then a cross descends from the top of the target down through its middle. You hit the spacebar at the right moment to score a bull. Failing to hit the target centrally results in a time penalty and there are five to hit in each group. Lots of tension.

The second full game in Sam 8 is **Quest**, an arcade adventure in the footsteps of Palace of Magic. Sad to say all I can report about this is that I've never been able to get anywhere! In theory you guide the hero, Walter Cobra, around looking for 12 power crystals and the Golden Dragon. Your major advantage is the jet boots that work in rooms containing triangular objects.

Other complications involve force fields and their power plants which need to be de-activated with stun grenades and computer terminals which have messages that can only be accessed if you have the password. Try it if you like tough adventures.

If you don't know who Repton is by now, where have you been? In **Around the World in 40 Screens** you have to guide our little green friend around scenarios based on Africa, Arctic, America, the Orient and the Oceans.

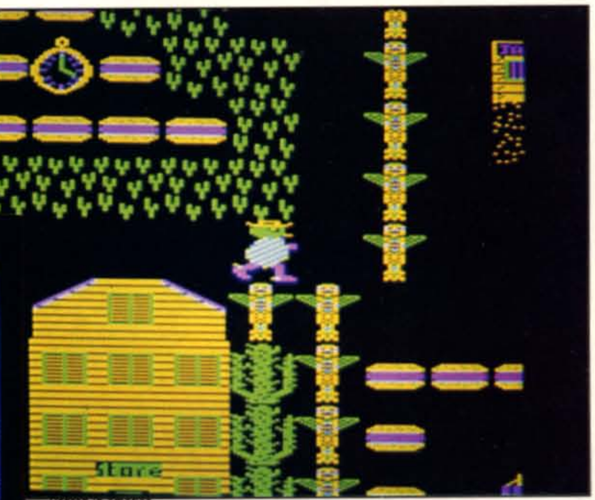
Having paddled around these screens a little in the past I know they're competently designed and quite fun. The Oceans in particular has been put together by someone with a twisted mind – the *safe* sprites are invisible. You've got the usual tune of course, and the standard quality of graphics.

The Superior game **Mr Wiz** dates back to 1984. The scenario is simple, if a little bizarre: You must guide Mr Wiz around the screen to eat up cherries. On the first level there are three nasties which appear from a mushroom and give chase. In general the baddies won't move through the earth which defines the paths they will follow – but if they get annoyed they will.

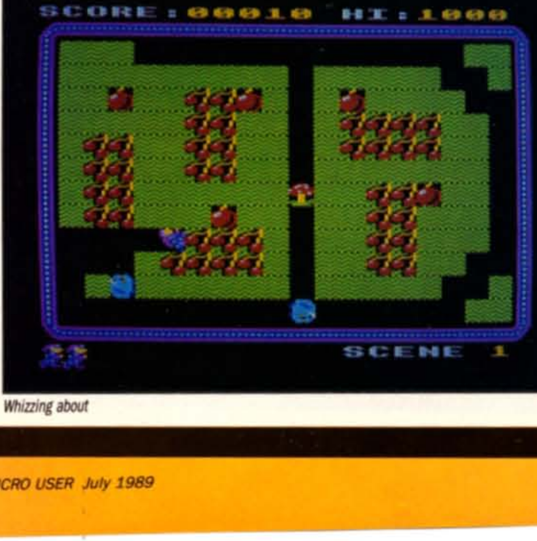
Annoying them seems easy to do – just eat the cherries, or worse yet their mushroom. You're not entirely defenceless because you do have a crystal ball to throw at them. It's a pleasant, smoothly programmed little game and, while the poor relation, it doesn't compare badly with the others.

Sam 8 is a reasonable collection, although I've had enough of Repton. As usual if you lack one of the games it's a good buy – if you're missing two or more it's a bargain.

Llewellyn



Repton in America



Whizzing about

Sound	*8*
Graphics	*9*
Playability	*8*
Value for money	*9*
Overall	*9*

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A stitch in time

The Mad Hatter gives beginners a helping hand

LEARNING how to solve adventures can be a lengthy task and resembles solving crosswords in some ways: Familiarity with the writers' style helps, but if you can't even get into the adventure you'll never make that first step. So this month we'll continue to examine the solution to *Lords of Time* from the novice's viewpoint.

The Contemporary Era is the correct one to explore first so, after turning the first cog and swinging the pendulum, you should begin by investigating the area outside the cottage. Don't forget to make a map as you go along – my solutions are not intended to take all the fun out of adventuring.

Proceed to the roadworks and collect the pick and planks before entering the cottage. Go upstairs and get the rucksack – it will enable you to carry more items – and then take the rope. Next you should examine the rubbish to find the tin-opener and afterwards get the jewellery case from the master bedroom.

Beginners should note that very often – if not invariably – in the early stages of an adventure an item will be located that helps you to carry more than you will be allowed to do unaided. In this particular case it is the rucksack – in **Dungeon Adventure** it was the packing case, and it could just as easily have been an empty sack or briefcase or something similar.

Help with carrying things may also prove to be something giving you extra strength, such as a ring or belt to wear, or a potion to drink. Always be on the lookout for this type of equipment from the very beginning.

Similarly, whenever you see a pile of rubbish, debris, leaves or junk of whatever kind, do try the command SEARCH or EXAMINE. In most cases a useful object will be concealed in the heap of whatever it is. Very rarely will it just be part of the scenery.

Back downstairs in the cottage, collect the spear from the hallway, the cat food from inside the kitchen cupboard and then go into the living room. Take the looking-glass and the metronome and go out into the garden via the patio.

You now have a fairly complicated chaining puzzle to unravel. This is one where various pieces of equipment have to be assembled or where various actions have to be completed in a particular order. Most adventures contain these, and some are more devious than others.

Ignore the compost heap at this stage, but collect the valerian from the flower garden. Valerian is a strongly-scented herb with magical properties – so far as this adventure is concerned, anyway. Thus you should experiment with any herb found in an adventure: Wave it, smell it, crush it or rub it in various locations to see what happens.

The same process should be used with any talisman, lamp or jewel you discover – you never know what might happen – but *do* save your position first in case you get transported to the back of beyond and can't find your way home again.

Next go SW from the patio and climb the fence and go N upstream. Here you will be opposite the narcissus, and you should tie the two planks together with the rope to form a bridge.

Anyone familiar with classical literature will be aware that Narcissus was a chap who liked looking at himself. In those days it meant gazing into water – no mirrors then – so in the end he was turned into a waterside flower. So what you need to do here is to cross the stream and give the Narcissus the looking-glass. You will be rewarded with a lodestone – a kind of magnet.

Proceed to the garden shed and WAVE the lodestone to obtain the key which is out of reach under the shed door. Things with magnetic properties are often used in this manner. If you find a locked door and a key out of reach, assume you have probably got to locate a magnet of some kind.

Go into the shed and collect the axe and shovel then return to the stream and the weeping willow. Now wave the valerian and you'll be told the tree feels suicidal. As you are in an obliging mood CUT the tree and you will be rewarded with the teardrop. Sometimes trees in adventures are meant to be cut down, at other times you should spare them. There is usually a clear hint as to which action is the most profitable.

Finally, make your way to the car port, OPEN the Porsche to get the petrol and go down to return to

Problem Corner

K.J. Terry is hunting for a disc version of *The Hobbit* for his BBC Micro. Has any reader finished with his? Only originals, please.

the clock, where you should leave your treasures. Note that I have purposely ignored the compost heap, since nothing can be profitably done with it until you have successfully negotiated the second time level – the Ice Age.

More next month, until then, happy adventuring.

Hatter's Helpline

Edward King is struggling away in Silversoft's hilarious **Bored of the Rings**, unable to find his way out of the Morona caves. He doesn't say exactly how or where he is stuck, but I wonder if he's bought the map from the pixie – he won't get out of the maze without it. I think I'd better serialise a solution soon – look out for it.

Two readers are stuck in that old favourite **Castle of Riddles**. Meredith Bock is probably trying to take the box in the awesome corridor before the monster is dead, but he should also throw the paint and rub the mirror in order to go safely N to the wooden chamber.

The giants' shooting gallery is also causing him problems. The correct sequence of action is as follows: N,NW,NE,SE,NE,NW,SW, DROP CASE (from the jet black passages), DROP BOX (from the awesome corridor), NW,NE NE. He'll now be in a riddle room and should go on a bit until he hears a distant explosion. Now he can safely return for the stole.

David de Ferrars wants to know how to navigate the jet black corridor maze. You can't map this maze by dropping things, because a dragon grabs anything dropped here. The secret lies in the black rod found by throwing the coin into the wishing well. Wave the rod in the different rooms of the maze and different coloured smoke will emerge from its tip. Thus you can find your way around and when you reach the exit you need to type in the word that comes to mind as a result of your experiences with the rod.

A number of readers have expressed great interest in the adventure **L** as a result of Bill Hensman's solution appearing in the column – and in particular, they want to know where it can be obtained. The address is The Association of Teachers of Mathematics, 7 Shaftesbury St, Derby DE3 8YB and the telephone number is 0332 46599. L costs £13.

Elite thoughts

The correspondence on Elite continues unabated, so where something new comes up I am compelled to include this superb arcade game in what is meant to be an adventuring column. Of course the amount of mail proves what an adventure the game really is.

Richard Gledhill questions my classifying the mystery ships as *Generation Ships*. Well, I've only had readers' descriptions to work from since I've still not encountered them myself.

Richard has this to say of his Master 128 version: "I first noticed the intruder when my jumpdrive stalled in the system of Laesinma – Galaxy 7 – for no apparent reason and I found myself being shot at from behind.

"The ship was not terribly aggressive. It tended to stay at a distance and take occasional potshots at me, but its presence prevented me from going anywhere, so I had to try and kill it.

"I soon found that it had an ECM system and seemed completely impervious to lasers, so I used the following tactic to get rid of it: Come to a stop in space and turn to keep the ship in view. Lock a missile on to it and wait for it to make an

Turn to Page 38 ▶

◀ From Page 37

attack run. Let it approach and fire the missile at the very last moment just as the mystery ship veers aside. The missile will detonate before the ship can activate its ECM system."

Richard adds that this works with any ship possessing an ECM and is particularly useful as a tactic for less experienced commanders to use against Thargoids. He also points out that, if your naval energy unit gets destroyed in combat you can only buy a civilian replacement. The answer here is always to save your position before launching and if losses are unacceptable to return to that position.

Richard's final point is a query to do with the way police Vipers attack you – or don't – when you are Fugitive. He wonders if there is any logic behind their behaviour. Does a reader have any information?

David de Ferrars has lost himself in the First Mission: At Reesdice he should press f6 – the Data on System key – and he will then be told where to go next. The Constrictor will be utterly unmistakable, and he certainly won't be able to destroy it at a distance.

P.S. Rose is adrift in Galaxy Five having missed the First Mission. What he should do now is move as rapidly as possible through the galaxies back to Galaxy One and he might well find that the mission is triggered. Failing that, since he is *Dangerous*, he could move on to Galaxy Three and try the second mission. The trip will set him back Cr. 30,000, but that can't be helped.

Old adventures – new machine

Archimedes owners who also have the PC emulator will be interested in the latest news from Topologika. The four BBC Micro adventure classics from the pens of Peter Killworth, Jonathan Partington and Jon Thackray are now available for the Archimedes on a single 3.5in disc.

Originally Acornsoft releases, **Countdown to Doom, Acheton, Philosopher's Quest** and **Kingdom of Hamil** are text-only adventures that should be in every addict's collection, and at £19.95 plus £1 for post and packaging the disc is excellent value for money. It is available from Topologika, P.O. Box 39, Stilton, Peterborough PE7 3RL.

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Cool it!

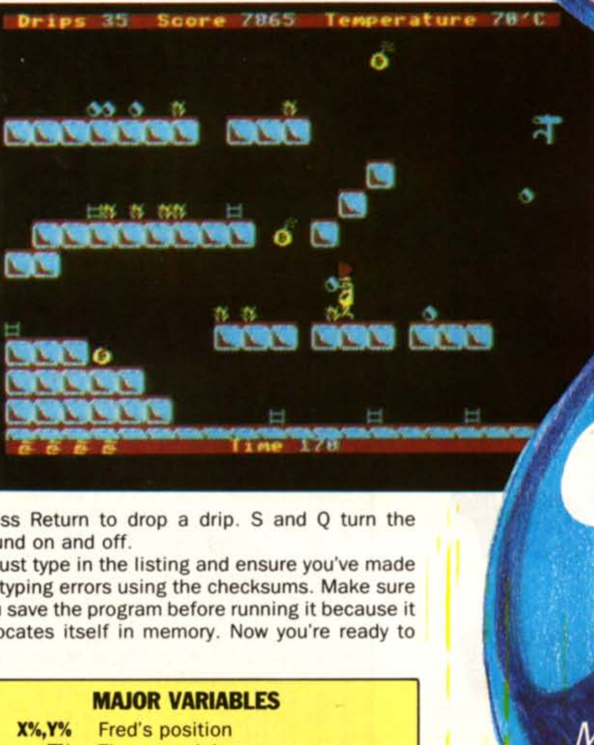
Matthew Eastmond presents a game that goes with a bang

FRED Drip needs your help. He has to keep the temperature of four bomb factories below 100 degrees Celcius, a task he accomplishes by collecting water from a dripping tap and extinguishing all the fires which break out around him. Every fire increases the temperature by five degrees – so putting one out reduces it by the same amount.

The odds are stacked against Fred and if a second fire appears on top of an existing one, putting it out will only lower the temperature by five degrees. So there's a gradual rise throughout the game.

Make sure Fred avoids the bouncing bombs which explode when he touches them and use the cunningly positioned extending ladders to reach higher platforms. Picking up heads gives extra lives. Fred is automatically transported to the next factory when the timer has expired.

Use Z and X to move Fred left and right and press Return to drop a drip. S and Q turn the sound on and off.



Just type in the listing and ensure you've made no typing errors using the checksums. Make sure you save the program before running it because it relocates itself in memory. Now you're ready to go.

MAJOR VARIABLES	
X%,Y%	Fred's position
T%	Time remaining
temp%	Current temperature
F%(),H%()	Positions of bombs
L%	Number of drips in Fred's bucket
li%	Number of lives
sc%	Current factory
s%	Fred's score

```
   10 REM Fred Drip
   20 REM by Matthew Eastmond
   30 REM (c) The Micro User
   40 *TV255
   50 ENVELOPE 1,1,1,1,1,1,1,1,0,0,0,-5,
120,120
   60 ENVELOPE 2,1,0,0,0,50,25,25,127,-1
,-1,-1,126,90
   70 ENVELOPE 3,129,-1,-1,-1,30,30,30,1
00,-1,-1,-1,100,0
   80 ENVELOPE 4,129,0,-10,-1,1,0,2,6,-1
,0,-1,126,74
   90 ENVELOPE 5,1,5,5,5,-5,-5,-5,15,15,
-9,-9,126,126
  100 VDU23,128,56,127,0,124,228,159,192
,252,23,129,252,198,227,241,255,255,254,
60,23,130,54,26,44,246,130,132,8,4
  110 VDU23,131,252,206,143,159,159,159,
254,60,23,132,56,48,48,48,48,48,28,28,23
,133,28,254,0,62,39,249,3,63
  120 VDU23,134,63,99,199,143,255,255,12
7,60,23,135,44,44,24,52,175,65,1,0,23,13
6,63,115,241,249,249,249,127,60
  130 VDU23,137,28,12,12,12,12,12,56,56,
23,138,255,255,255,255,126,126,60,0,23,1
45,15,63,127,255,255,127,63,15
  140 VDU23,146,240,252,254,255,255,254,
252,240,23,139,1,127,159,143,127,0,0,0,2
```

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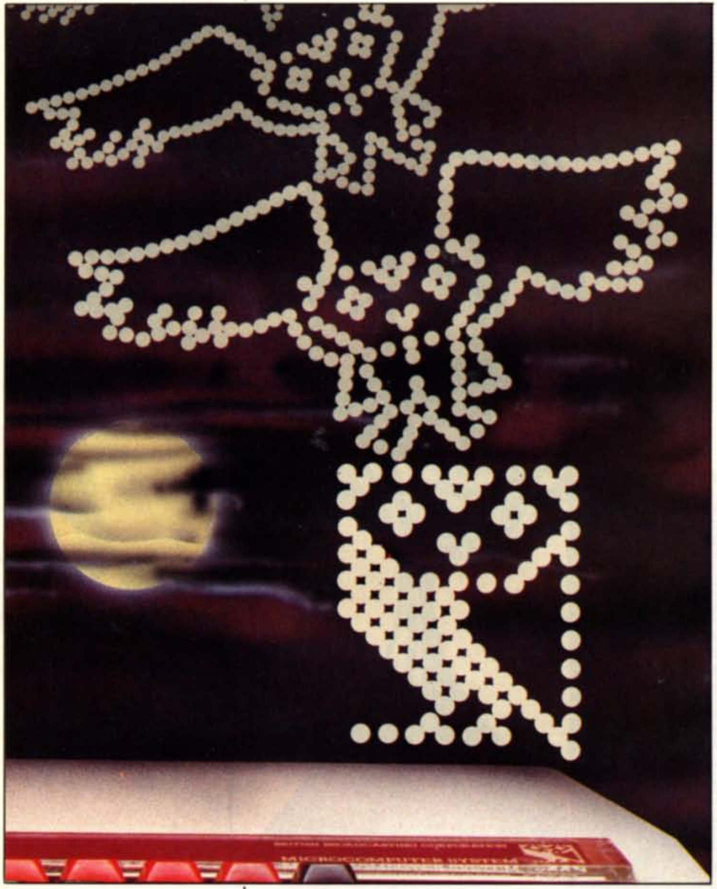

Faster than Basic

Eric Crisp becomes more colourful but needs to move faster as he continues his fascinating series on BBC Micro animation

LAST month we managed to get our moving ball to roll, followed by a walking man. However our little chap lacked both colour and body. So now we're going to take a look at using multi-coloured sprites. Program I turns him into a real, full-bodied man in glorious Mode 1 colour.

It is very similar to last month's, the changes being:

- Lines 1 to 6 define three shapes for the red part of the man.
- Lines 7 to 9 and 11 to 13 define the yellow parts.
- Lines 75 and 80 plot the red part.
- Lines 82 and 85 plot the yellow part.

Where red and yellow parts overlap, the result is white – colour 1 exclusive-ored with 2 gives 3.

On running it, the man looks great, but he is slow and flickery. No amount of fiddling about with delays and the position of the *FX19 makes much difference simply because BBC Basic is too slow. It cannot draw the more complicated shape within one screen refresh. The solution is to turn to machine code. *Argh ... not machine code* you cringe. Don't worry, a ready-made sprite routine is included – the instructions start in the panel opposite.

The routines use sprite data stored in memory rather than character definitions and we just happen also to include a sprite definer as well – isn't that convenient? A description of how to use it is at the end of this article.

To demonstrate the difference machine code routines make we need to define the three man shapes. Use the definer to create them in Mode 1 using the diagrams on the facing page as a guide. The numbers 1, 2 and 3 represent the colour for that pixel. They each measure 8 pixels wide by 16 pixels high and you should save them as MAN1, MAN2 and MAN3.

Having defined the sprite shapes, the walking

```
 1 VDU 23,224,0,12,28,24,24,60,60,127
 2 VDU 23,225,0,12,28,24,24,60,60,62
 3 VDU 23,226,0,12,28,24,24,60,60,62
 4 VDU 23,227,188,0,0,0,0,0,67,32
 5 VDU 23,228,60,0,0,0,128,128,0,12
 6 VDU 23,229,61,0,0,0,0,4,2,48
 7 VDU 23,230,24,48,32,0,24,60,52,56
 8 VDU 23,231,24,48,32,0,24,60,52,56
 9 VDU 23,232,24,48,32,0,24,60,60,60
10 MODE 1:VDU 23;8202;0;0;0;
11 VDU 23,233,60,24,24,60,36,102,0,0
12 VDU 23,234,60,24,24,24,120,8,8,0
13 VDU 23,235,60,24,28,22,18,48,32,0
15 K%=0:VDU 5:C%=0
18 GCOL 3,2:PROCBIGMAN(K%,C%)
20 FOR I%=1 TO 60
22 D%=C%:C%=I% MOD 3
23 *FX19
24 FOR J%=1 TO 35:NEXT
25 PROCBIGMAN(K%,D%)
30 PROCBIGMAN(I%,C%)
40 FOR J%=1 TO 400:NEXT
45 K%=I%
50 NEXT
60 GOTO 500
70 DEFPROCBIGMAN(A%,B%)
75 GCOL 3,1
80 MOVE A%*8,380:VDU 224+B%,10,8,227+B%
82 GCOL 3,2
85 MOVE A%*8,380:VDU 230+B%,10,8,233+B%
90 ENDPROC
```

Program I

man program needs modifying, resulting in Program II.

The changes to Program I are the set-up lines 1 to 15, the removal of any GCOL statements, the deletion of line 25 and changes to the procedure PROCMAN. The third parameter is a flag to indicate whether the sprite is being drawn in one place – use 0 – or if it is being moved – value of 1.

```
  1 XORD=&70:YORD=&72
  2 WIDE=&74:HIGH=&75:SDAT=&76
  3 SPRITE=&903:SPRITEMOVE=&900
  4 W%=8:H%=16
  5 *LOAD SPRTcod 0900
 10 MODE1:VDU23;8202;0;0;0;
 11 HIMEM=&2800
 12 *LOAD MAN1 2800
 13 *LOAD MAN2 2820
 14 *LOAD MAN3 2840
 15 K%=0:C%=0
 18 PROCMAN(K%,C%,0)
 20 FOR I%=1 TO 60
 22 D%=C%:C%=I% MOD 3
 23 *FX19
 24 FOR J%=1 TO 35:NEXT
 30 PROCMAN(I%,C%,1)
 40 FORJ%=1TO400:NEXT
 45 K%=I%
 50 NEXT
 60 END
 70 DEFPROCMAN(A%,B%,F%)
 80 X%=A%*16:Y%=380
 81 MANDATA=&2800+&20*C%
 82 !XORD=Y%*&10000+X%
 83 !WIDE=W%+256*H%+&10000*MANDATA
 85 IF F%=0 CALL SPRITE ELSE CALL SPRITEMOVE
 90 ENDPROC
```

Program II

The sprite has a minimum movement horizontally of one screen byte – equivalent to 16 graphic points – so *X%* changes in multiples of 16 instead of eight – line 80. The value put in *SDAT* cycles between &2800, &2820 and &2840 so that the three sprites are used in turn.

On running the program, the sprite looks the same as before, but it is no longer flickery and moves further at each step. Try running the program with lines 23, 24 and 40 missing. Fast eh?

● *That's it for this session, have fun playing with the routines. Next month, ways of moving sprites and user control will be explored.*

USING THE SPRITE ROUTINE

The &102 (258) byte sprite routine is assembled at &900 and saved as SPRTcod. The code can be loaded, ready-assembled or assembled at run time by including the listing in your program. It can be assembled where you wish by changing the value of *P%* on line 130.

The code has two entry points, labelled *SPRITEMOVE* and *SPRITE*. These are at the start of the code – &900 – and at the start+3 – &903 – respectively. *SPRITEMOVE* should not be CALLed before *SPRITE*.

Entry *SPRITE* causes a sprite to be exclusive-

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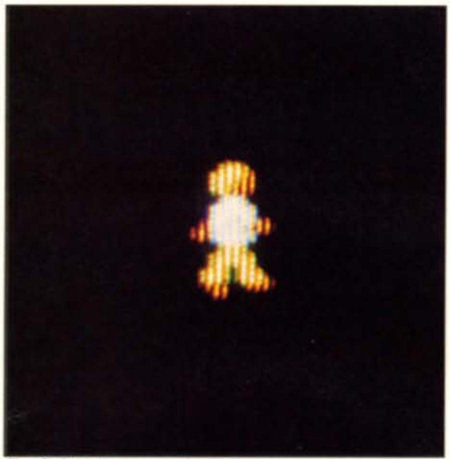


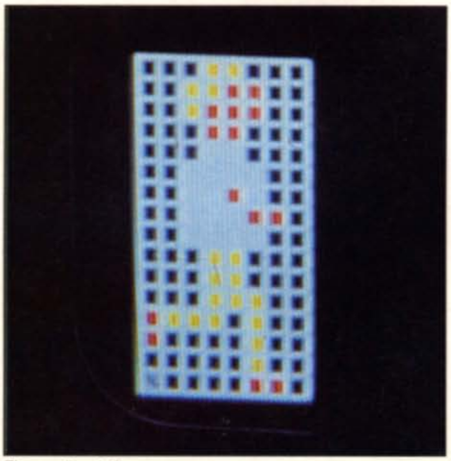
The finished man on the move

MAN 1							
.	.	.	2	2	.	.	.
.	.	2	2	1	1	.	.
.	.	2	1	1	1	.	.
.	.	.	1	1	.	.	.
.	.	.	3	3	.	.	.
.	.	3	3	3	3	.	.
.	.	3	3	1	3	.	.
.	1	3	3	3	1	1	1
1	.	3	3	3	3	.	.
.	.	.	2	2	.	.	.
.	.	.	2	2	.	.	.
.	.	2	2	2	2	.	.
.	.	2	.	.	2	.	.
.	2	2	.	.	2	2	.
.	1	.	.	.	.	1	1
.	.	1	.	.	.	.	.

MAN 2							
.	.	.	2	2	.	.	.
.	.	2	2	1	1	.	.
.	.	2	1	1	1	.	.
.	.	.	1	1	.	.	.
.	.	.	3	3	.	.	.
.	.	3	3	3	3	.	.
.	.	3	3	1	3	.	.
.	.	3	3	3	1	1	.
.	.	3	3	3	3	.	.
.	.	.	2	2	.	.	.
.	.	.	2	2	.	.	.
.	.	.	2	2	2	.	.
1	2	2	2	.	2	.	.
1	.	.	.	.	2	.	.
.	.	.	.	.	2	.	.
.	.	.	.	.	1	1	.

MAN 3							
.	.	.	2	2	.	.	.
.	.	2	2	1	1	.	.
.	.	2	1	1	1	.	.
.	.	.	1	1	.	.	.
.	.	.	3	3	.	.	.
.	.	3	3	3	3	.	.
.	.	3	3	3	3	.	.
.	.	3	3	3	3	1	.
.	.	3	3	3	3	.	1
.	.	.	2	2	.	.	.
.	.	.	2	2	2	.	.
.	.	.	2	.	2	2	.
.	.	.	2	.	.	2	.
.	.	2	2	.	1	.	.
.	.	2	.	.	.	1	.
.	.	1	1	.	.	.	.

Diagrams of the man in three positions



The sprite definer

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ored on to the screen where as *SPRITEMOVE* exclusive-ors the last sprite drawn, so removing it, and exclusive-ors the new one.

Both entry points have the same requirements:

- Set the coordinates for the top left corner of the new sprite by poking the coordinates into &70,71 and &72,73 – *XORD* and *YORD* respectively. This is can be achieved with:

```
!XORD=X+Y*&10000
```

where *X* and *Y* are the graphic coordinates and *XORD* is set to &70.

- Set the sprite's width and height – in pixels – by poking them into &74 and &75 respectively.
- Set the start address in memory of the new sprite data by poking it into &76,77 – *SDAT*. This can be done – along with the width and height – using:

```
!WIDE=W%+256*H%+&10000*A%
```

where *W%* is the width, *H%* the height, *A%* the sprite address and *WIDE* is &74.

Each time either *SPRITE* or *SPRITEMOVE* are CALLed, the three steps above must be carried out.

Sprite data needs loading into memory by your program – having first created and saved them with the sprite definer – but an area of memory must be set aside for it. This can be done by setting HIMEM to a lower value than normal.

For example, the instruction HIMEM=HIMEM–200 reserves 200 bytes of memory. This must be done after selecting the

Sprite animator

```
   10 REM M/code sprites
   20 REM by Eric H. Crisp
   30 REM (c) The Micro User
   40 MODE7
   50 XORD=&70:YORD=&72
   60 WIDE=&74:HIGH=&75
   70 SDAT=&76:SDATOLD=&7A
   80 SCRN=&78:SCRNOLD=&7C
   90 ZSCRN=&7E
  100 WIDEOLD=&80:HIGHOLD=&81
  110 INPUT"Screen mode to use
",SMODE
  120 IF SMODE>3 SMODE1=2 ELSE
 SMODE1=1
  130 IFSMODE=0 SMODE2=3 ELSEI
F SMODE=1 OR SMODE=4 SMODE2=2
ELSE SMODE2=1
  140 LINSTEP=&280/SMODE1
  150 FOR I%=0 TO 2 STEP 2
  160 P%=&900:[OPT I%
  170 .SPRITEMOVE
  180 JSR SPLOT
  190 .SPRITE
  200 LDA YORD
  210 LSR YORD+1
  220 ROR A
  230 LSR YORD+1
  240 ROR A
  250 EOR #255
  260 TAX
  270 LSR A
  280 LSR A
  290 AND #&FE
  300 TAY
  310 LDA TABLE+1,Y
  320 STA SCRN+1
  330 TXA
  340 AND #7
  350 CLC
  360 ADC TABLE,Y
  370 STA SCRN
  380 LDA XORD
  390 LDX #SMODE1
  400 .CONVERT1
  410 LSR XORD+1
  420 ROR A
  430 DEX
  440 BNE CONVERT1
  450 AND #&F8
  460 CLC
  470 ADC SCRN
  480 STA SCRN
  490 LDA SCRN+1
  500 ADC XORD+1
  510 STA SCRN+1
  520 LDA WIDE
  530 ADC #1
  540 LDX #SMODE2
  550 .CONVERT2
  560 LSR A
  570 DEX
  580 BNE CONVERT2
  590 STA WIDE
  600 JSR COPYOLD
  610 JSR SPLOT
  620 .COPYOLD
  630 LDA SCRN
  640 STA SCRNOLD
  650 LDA SCRN+1
  660 STA SCRNOLD+1
  670 LDA SDAT
  680 STA SDATOLD
  690 LDA SDAT+1
  700 STA SDATOLD+1
  710 LDA HIGH
  720 STA HIGHOLD
  730 LDA WIDE
  740 STA WIDEOLD
  750 RTS
  760 .SPLOT0
  770 INC SDATOLD+1
  780 BNE SPLOT3
  790 .SPLOT
  800 LDY SCRNOLD+1
  810 LDA SCRNOLD
  820 .SPLOT1
  830 STY ZSCRN+1
  840 LDX HIGHOLD
  850 LDY #0
  860 STA ZSCRN
  870 .SPLOT2
  880 LDA (ZSCRN),Y
  890 EOR (SDATOLD),Y
  900 STA (ZSCRN),Y
  910 INC SDATOLD
  920 BEQ SPLOT0
  930 .SPLOT3
  940 INC ZSCRN
  950 LDA ZSCRN
  960 AND #7
  970 BEQ SPLOT7
  980 .SPLOT4
  990 DEX
 1000 BNE SPLOT2
 1010 LDY SCRNOLD+1
 1020 LDA SCRNOLD
 1030 CLC
 1040 ADC #8
 1050 STA SCRNOLD
 1060 BCS SPLOT6
 1070 .SPLOT5 DEC WIDEOLD
 1080 BNE SPLOT1
 1090 RTS
 1100 .SPLOT6 INY
 1110 STY SCRNOLD+1
 1120 BNE SPLOT5
 1130 .SPLOT7
 1140 LDA ZSCRN
 1150 BEQ SPLOT9
 1160 .SPLOT8
 1170 CLC
 1180 ADC #(LINSTEP-8)MOD256
 1190 STA ZSCRN
 1200 LDA ZSCRN+1
 1210 ADC #(LINSTEP-8)DIV256
 1220 STA ZSCRN+1
 1230 ASL A
 1240 BCC SPLOT4
 1250 DEX
 1260 TXA
 1270 LDX #1
 1280 CLC
 1290 ADC SDATOLD
 1300 STA SDATOLD
 1310 BCC SPLOT4
 1320 INC SDATOLD+1
 1330 BNE SPLOT4
 1340 .SPLOT9
 1350 INC ZSCRN+1
 1360 BNE SPLOT8
 1370 .TABLE
 1380 ]:P%=P%+64:[OPT I%
 1390 .ZEND:]:NEXT
 1400 FORI%=0TO31
 1410 TABLE!(2*I%)=&8000-(&500
0-I%*&280)/SMODE1
 1420 NEXT
 1430 *SAVE SPRTcod 0900 0A02
```

screen mode since MODE always sets the value of HIMEM to the start of screen memory. And it must not be done inside a procedure or function.

Having changed HIMEM, each sprite is then *LOADed. The load address of the first sprite is the new value of HIMEM – in hexadecimal – the next sprite's is at HIMEM plus length of the first sprite's data and so on. These load addresses are the values that are poked into *SDAT* to select individual sprites.

The final walking man program carries out the necessary steps outlined above including a procedure for calling the relevant routine.

To rubout a sprite – rather than just moving it – CALL SPRITE with the coordinates and sprite address set to the last values used.

If the screen is allowed to scroll the sprites may not appear where you want them. Scrolling can be prevented by creating a text window, for example in Mode 1 use VDU 28,0,30,39,0.

Ensure the sprite routine is assembled for the mode in which you are going to use it.

The sprite can be placed on the screen to a vertical resolution of one pixel – four graphic points – but to a horizontal resolution of only one screen byte which is 16 graphic points in Modes 0, 1 and 2 and 32 graphic points in Modes 4 and 5. There is little point in trying to move the sprite smaller distances than this as it will not usually show.

The routines do not check the validity of the values passed to them, so your program will need to ensure that sprites are not placed off the screen. If this does happen the result could be either interesting or, more likely, disastrous.

Get it right!

```
  10 =    0 0 | 490 = AAF8 A |  970 = 597F 6
  20 =    0 0 | 500 = 222D 4 |  980 = 53A6 B
  30 =    0 0 | 510 = 3B21 F |  990 = E8A9 5
  40 = 8AFC C | 520 = A20A 7 | 1000 = 3FB8 8
  50 = 9382 E | 530 = B19F A | 1010 = C1AC B
  60 = 9139 E | 540 = 91A6 6 | 1020 = DD4E 3
  70 = 6E32 3 | 550 = B932 6 | 1030 = 74FB D
  80 = 748E 2 | 560 = 1A09 9 | 1040 = 20B6 5
  90 = 65BE 9 | 570 = E8A9 B | 1050 = 97D6 B
 100 = FE09 7 | 580 = B62A A | 1060 = 9C70 1
 110 = 16A6 6 | 590 = 7107 6 | 1070 = 508E 5
 120 = 8BBC 0 | 600 = E8FD 6 | 1080 =  FDB A
 130 = 73C0 2 | 610 = EDB8 6 | 1090 = 9843 6
 140 = 1DE7 3 | 620 = AD07 1 | 1100 = F435 F
 150 = A418 6 | 630 = B784 8 | 1110 = 211A 8
 160 = 80E1 2 | 640 = 97D6 2 | 1120 = 4F5F A
 170 = 8E72 B | 650 = AAF8 E | 1130 = 63C5 8
 180 = EDB8 B | 660 = D6A9 4 | 1140 = 7BA0 5
 190 = 364D B | 670 = D74F 6 | 1150 = B8B1 5
 200 =  B04 F | 680 = C613 8 | 1160 = 922A B
 210 = 7784 4 | 690 = C9F5 9 | 1170 = 74FB 8
 220 = 856E 1 | 700 = 62CE A | 1180 = B0E8 2
 230 = 7784 A | 710 = E9BD 9 | 1190 = 8DBE 7
 240 = 856E A | 720 = 6D14 2 | 1200 = 9D27 6
 250 = CC15 E | 730 = A20A 7 | 1210 = 5D80 D
 260 = 670E A | 740 =  7D2 C | 1220 = D7BF 2
 270 = 1A09 E | 750 = 9843 E | 1230 = 6311 B
 280 = 1A09 F | 760 = 1322 A | 1240 = 8186 9
 290 = FB6B 1 | 770 = 7F47 9 | 1250 = E8A9 E
 300 = 772F B | 780 = 2F99 F | 1260 = 5DFD B
 310 = BDB9 F | 790 = 543F 4 | 1270 = FA64 F
 320 = 3B21 E | 800 = C1AC 6 | 1280 = 74FB 1
 330 = 5DFD 9 | 810 = DD4E A | 1290 = 616C 8
 340 = 4EFF D | 820 =  303 4 | 1300 = C613 A
 350 = 74FB A | 830 = ADBE 4 | 1310 = 8186 9
 360 = 44E8 2 | 840 = B6AE 6 | 1320 = 7F47 F
 370 = 6489 D | 850 = 9CF1 F | 1330 = 5F7E 8
 380 = 7DB0 7 | 860 = 8DBE F | 1340 = 820B 2
 390 = A1C5 D | 870 = 3360 6 | 1350 = 468F 3
 400 = 8951 4 | 880 = 6EAB 3 | 1360 = 9EF2 0
 410 = 3224 B | 890 = 5628 F | 1370 = 12BA A
 420 = 856E 3 | 900 = 8E1D B | 1380 = 91A5 4
 430 = E8A9 2 | 910 = 5723 0 | 1390 = C605 0
 440 = 8649 0 | 920 = 2998 2 | 1400 = 18F2 4
 450 = 5451 F | 930 = 2341 1 | 1410 = 96C2 B
 460 = 74FB 1 | 940 = FDF3 5 | 1420 = 2C83 2
 470 = 6AA0 E | 950 = 7BA0 5 | 1430 = B4D5 B
 480 = 6489 1 | 960 = 4EFF 8 |
```

USING THE SPRITE DEFINER

The best way to learn how to use the definer is to practice with it for a while. Don't worry if a wrong selection is made at any time, just press Escape followed by the spacebar. This returns you to the main menu without losing any of your work.

On running the program enter 0, 1, 2, 4 or 5 for the mode, then enter the width and height measured in pixels. The width should be in multiples of two for Modes 2 and 5, four for Modes 1 and 4 and eight for Mode 0. Enter 3 from the main menu to select edit and choose sprite 1, 2, 3 or 4. A squared box of the right size then appears, with a cursor flashing in one square which represents a single pixel.

The cursor is moved using the arrow keys. Colour selection is made by pressing a number between 0 and 9 or a letter from A to F – where A is 10, B is 11 and so on. A pixel is filled with the selected colour by pressing the Spacebar or Copy.

For a start just fill a few squares with colour. As you do the sprite you are creating appears on the right of the screen. To finish editing, press Q for quit, to take you back to the main menu. To save the sprite just created to tape or disc select save – by entering 2 – enter the sprite number and then a filename.

This saved sprite can then be loaded as a different sprite number so that you can make small changes for animation purposes. Select load, choose a different sprite and enter the filename. An identical sprite appears on the right of the screen. To exit the program select option 5 from the main menu but remember to save any sprites you want to keep first.

The number of bytes occupied by a sprite definition is given by W*H/n where *W* and *H* are the width and height in pixels, and *n* is eight in Modes 0 and 4, four in Modes 1 and 5, and two in Mode 2.

Lines 1000, 1001 and 1002 in the sprite

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"The sprite looks the same but it is no longer flickery"

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definer contain data for the colour used in VDU 19 commands. The values currently there are the defaults, but they can be changed to your requirements. Line 1000 is for Modes 0 and 4, line 1001 for Modes 1 and 5 and line 1002 for Mode 2.

Menu item 4 – mask – will be dealt with another month.

Sprite definer

```
   10 REM Sprite definer
   20 REM by Eric H. Crisp
   30 REM (c) The Micro User
   40 MODE 7
   50 F%=0
   60 REPEAT
   70 REPEAT:INPUT"Screen mode to use",S
MODE:UNTIL SMODE<>3 AND SMODE<6
   80 INPUT"Width and height",W%,H%
   90 IF SMODE>3 SMODE1=2 ELSE SMODE1=1
  100 IF SMODE=0 SMODE2=3 ELSE IF SMODE=
1 OR SMODE=4 SMODE2=2 ELSE SMODE2=1
  110 IF H%>64 OR W%>16*2^SMODE2 F%=1:PR
INT"Width/height too large"
  120 UNTIL F%=0
  130 WB%=W%/(2^SMODE2*SMODE1)
  140 MODE SMODE
  150 VDU23;8202;0;0;0;
  160 DATA 0,7,-1
  170 DATA 0,1,3,7,-1
  180 DATA 0,1,2,3,4,5,6,7,8,9,10,11,12,
13,14,15,-1
  190 DATA -1
  200 ON ERROR GOTO 1360
  210 RESTORE (SMODE MOD 4)*10+160
  220 V%=0
  230 READ C%
  240 IF C%<>-1 REPEAT:VDU 19,V%,C%;0;:R
EAD C%:V%=V%+1:UNTIL C%=-1
  250 HIMEM=&2BFF
  260 REPEAT
  270 REPEAT
  280 *FX 4
  290 *FX 15
  300 VDU 28,0,31,16*2^(SMODE2-1)-1,0,12
  310 PRINT "1. Load"'"2. Save"'"3. Ed
it"'"4. Mask"'"5. Exit"'
  320 INPUT"Enter option",O%
  330 UNTIL O%>0 AND O%<6
  340 IF O%<5 PRINT:REPEAT:INPUT"Enter s
prite no.",S%:UNTIL S%>0 AND S%<5
  350 IF O%=1 PROCLOAD ELSE IF O%=2 PROC
SAVE ELSE IF O%=3 PROCEDIT ELSE IF O%=4
PROCMASK
  360 IF O%=5 CLS:PRINT"Are you sure?":K
%=GET:IF (K% OR 32)<>121 O%=0
  370 UNTIL O%=5
  380 MODE 7
  390 END
  400 DEFPROCLOAD
  410 PRINT'"Enter name"
  420 INPUT N$
  430 $&880="LOAD "+N$+" 2C00"
  440 X%=&80:Y%=8:CALL &FFF7
  450 FOR I%=0 TO WB%-1
  460 Z%=&B00+&2700*SMODE1+I%*8+(S%-1)*(
3-SMODE1)*&A00
  470 FOR J%=0TOH%-1 STEP 4
  480 !Z%=!(&2C00+J%+I%*H%)
  490 Z%=Z%+4
  500 IF Z% MOD 8=0 Z%=Z%+&140*(3-SMODE1
)-8
  510 NEXT
  520 NEXT
  530 ENDPROC
  540 DEFPROCSAVE
  550 PRINT'"Enter name"
  560 INPUT N$
  570 L%=WB%*H%:L$=""
  580 REPEAT
  590 M%=48+L% MOD 16
  600 IF M%>57 M%=M%+7
  610 L$=CHR$(M%)+L$
  620 L%=L% DIV 16
  630 UNTIL L%=0
  640 $&880="SAVE "+N$+" 2C00 +"+L$
  650 FOR I%=0 TO WB%-1
  660 Z%=&B00+&2700*SMODE1+I%*8+(S%-1)*(
3-SMODE1)*&A00
  670 FOR J%=0 TO H%-1 STEP 4
  680 !(&2C00+J%+I%*H%)=!Z%
  690 Z%=Z%+4
  700 IF Z% MOD 8=0 Z%=Z%+&140*(3-SMODE1
)-8
  710 NEXT
  720 NEXT
  730 X%=&80:Y%=8:CALL &FFF7
  740 ENDPROC
  750 DEFPROCEDIT
  760 VDU 24,0;0;1023;1023;
  770 CLG
  780 GCOL 0,(V%-1) MOD 8
  790 PW%=2^(6-SMODE2)
  800 MOVE 0,0
  810 MOVE 0,16*H%
  820 PLOT 85,PW%*W%,0
  830 PLOT 85,PW%*W%,16*H%
  840 VDU 24,0;0;1279;1023;
  850 DX%=PW%/4
  860 T%=1280-4*H%-256*S%
  870 FOR X%=0 TO DX%*W%-DX% STEP DX%
  880 FOR Y%=0 TO 4*H%-4 STEP 4
  890 C%=POINT(X%+1024,Y%+T%)
  900 GCOL 0,C%
  910 PROCBLOCK
  920 NEXT
  930 NEXT
  940 *FX15
  950 *FX4,1
  960 F%=0
  970 NX%=0
  980 NY%=0
  990 REPEAT
 1000 K%=INKEY(10)
 1010 X%=NX%
 1020 Y%=NY%
 1030 IF K%>47 AND K%<58 C%=K%-48
 1040 IF (K% OR 32)>96 AND (K% OR 32)<10
3 C%=(K% OR 32)-87
 1050 IF K%=136 NX%=NX%-DX%:IF NX%<0 NX%
=DX%*W%-DX%
 1060 IF K%=137 NX%=NX%+DX%:IF NX%>=DX%*
W% NX%=0
 1070 IF K%=138 NY%=NY%-4:IF NY%<0 NY%=4
*H%-4
 1080 IF K%=139 NY%=NY%+4:IF NY%>=4*H% N
Y%=0
 1090 IF (NX%=X% AND NY%=Y%) OR F%<>0 PR
OCFILL(-1)
 1100 IF K%=135 OR K%=32 PROCFILL(C%)
 1110 UNTIL CHR$(K% OR 32)="q"
 1120 ENDPROC
 1130 DEFPROCFILL(B%)
 1140 IF B%=-1 GCOL 3,7:F%=F% EOR 1:ELSE
 GCOL 0,B%:PLOT 69,X%+1024,Y%+T%:F%=0
 1150 PROCBLOCK
 1160 ENDPROC
 1170 DEFPROCBLOCK
 1180 MOVE X%*4+DX%,Y%*4+4
 1190 MOVE X%*4+DX%,Y%*4+12
 1200 PLOT 85,X%*4+3*DX%,Y%*4+4
 1210 PLOT 85,X%*4+3*DX%,Y%*4+12
 1220 ENDPROC
 1230 DEFPROCMASK
 1240 PW%=2^(6-SMODE2)
 1250 DX%=PW%/4
 1260 T%=1280-4*H%-256*S%
 1270 FOR X%=0 TO DX%*W%-DX% STEP DX%
 1280 FOR Y%=0 TO 4*H%-4 STEP 4
 1290 C%=POINT(X%+1024,Y%+T%)
 1300 IF C%=0 C%=15 ELSE C%=0
 1310 GCOL 0,C%
 1320 PLOT 69,X%+1024,Y%+T%
 1330 NEXT
 1340 NEXT
 1350 ENDPROC
 1360 CLS
 1370 PRINT"ERROR NO. ";ERR
 1380 PRINT'"AT LINE ";ERL
 1390 PRINT'"PRESS SPACE"
 1400 REPEAT UNTIL INKEY-99
 1410 GOTO 210
```

Get it right!

```
  10 =    0 0 |  480 = BC9E 8 |  950 = E383 E
  20 =    0 0 |  490 = 9E29 F |  960 = 61A9 2
  30 =    0 0 |  500 = 1869 D |  970 =  694 7
  40 = 1092 2 |  510 = 2C83 A |  980 = 7020 A
  50 = 61A9 7 |  520 = 2C83 6 |  990 = BFBA 0
  60 = BFBA 0 |  530 = ED0F C | 1000 = 41C6 F
  70 = 91FC 6 |  540 = E920 A | 1010 = B627 5
  80 =  8C8 5 |  550 = 9FE5 A | 1020 = C0B6 A
  90 = 8BBC F |  560 = CDCA A | 1030 = F21D 2
 100 = CC9E 7 |  570 = 9AE0 A | 1040 = 67A6 A
 110 = A510 D |  580 = BFBA 5 | 1050 = 3582 C
 120 = B6E2 5 |  590 = 843F E | 1060 =  9E0 C
 130 = A73D F |  600 = 40FA 7 | 1070 = D311 5
 140 = 22CB 9 |  610 =  88E 4 | 1080 =  7D7 4
 150 = F716 0 |  620 = E9AD E | 1090 = C701 4
 160 = 3D1C E |  630 = DE49 D | 1100 = F6F5 B
 170 = C40A 7 |  640 = 4F8E 8 | 1110 = C44A 0
 180 =  59D 5 |  650 = 93DB A | 1120 = ED0F D
 190 = 373F F |  660 = 6208 9 | 1130 = AE1E C
 200 = 1962 E |  670 = 4853 1 | 1140 = BA2A 1
 210 = 8878 3 |  680 = CBF7 5 | 1150 = FE15 B
 220 = 7A0E 3 |  690 = 9E29 B | 1160 = ED0F 4
 230 = AE0F 4 |  700 = 1869 0 | 1170 = 5571 0
 240 = A329 9 |  710 = 2C83 4 | 1180 = EAF3 C
 250 =   36 4 |  720 = 2C83 4 | 1190 = 4680 5
 260 = BFBA 8 |  730 = 18CB E | 1200 = 481C D
 270 = BFBA D |  740 = ED0F 7 | 1210 = 3C28 C
 280 = 8041 8 |  750 = 2FB3 F | 1220 = ED0F C
 290 = 498B D |  760 = 1723 6 | 1230 = 4EE6 B
 300 = 7BC0 0 |  770 = 6A37 3 | 1240 = D366 A
 310 = 80E2 7 |  780 = 7B9C 8 | 1250 = 5C0B F
 320 = E87E C |  790 = D366 3 | 1260 = 35B4 1
 330 = 77E1 4 |  800 = 3714 D | 1270 = 1637 7
 340 = 2073 6 |  810 = F2E3 6 | 1280 = 423D 5
 350 =  788 D |  820 = A69E 8 | 1290 = 6D38 7
 360 = 4558 B |  830 = BE53 F | 1300 =  FA6 6
 370 = 1530 5 |  840 = 6AB4 0 | 1310 = FD7B 8
 380 = 1092 E |  850 = 5C0B D | 1320 = ABD8 4
 390 = FD2E D |  860 = 35B4 6 | 1330 = 2C83 5
 400 = B7AD 5 |  870 = 1637 4 | 1340 = 2C83 D
 410 = 9FE5 9 |  880 = 423D 7 | 1350 = ED0F E
 420 = CDCA A |  890 = 6D38 C | 1360 = 7A16 9
 430 = E8D2 B |  900 = FD7B 5 | 1370 = 49F2 E
 440 = 18CB 5 |  910 = FE15 B | 1380 =  E50 A
 450 = 93DB 0 |  920 = 2C83 D | 1390 = EF31 5
 460 = 6208 1 |  930 = 2C83 4 | 1400 = AD81 0
 470 = CA90 2 |  940 = A022 6 | 1410 = 4381 D
```

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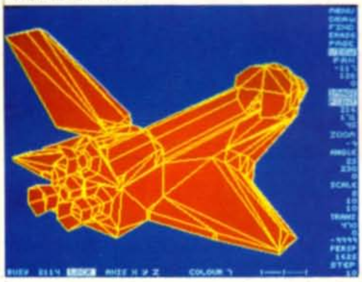

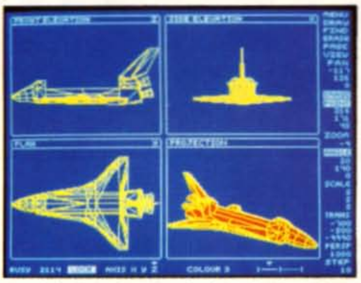

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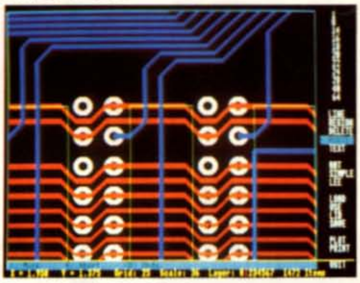

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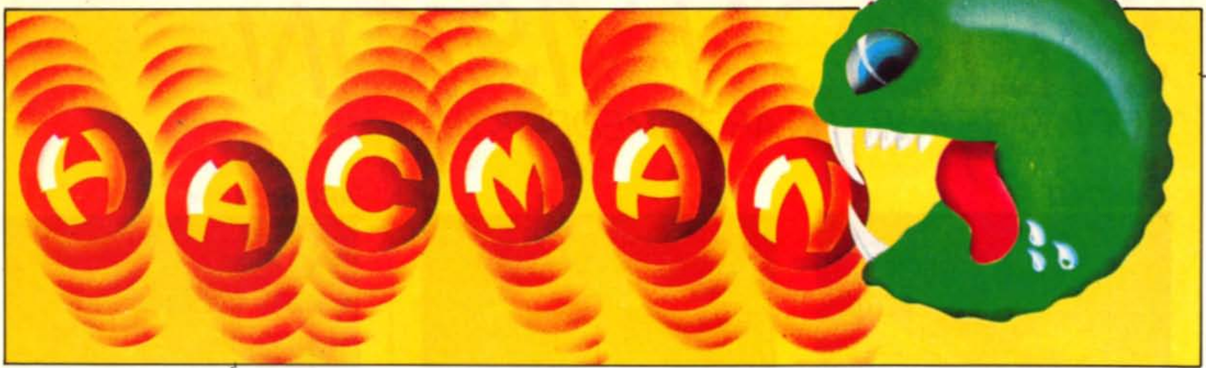


Duffing droids without danger

Hac Man takes another look at some old favourites

B B+ M

Featuring

Codename:Droid
Bonecruncher
Arkanoid
Cholo

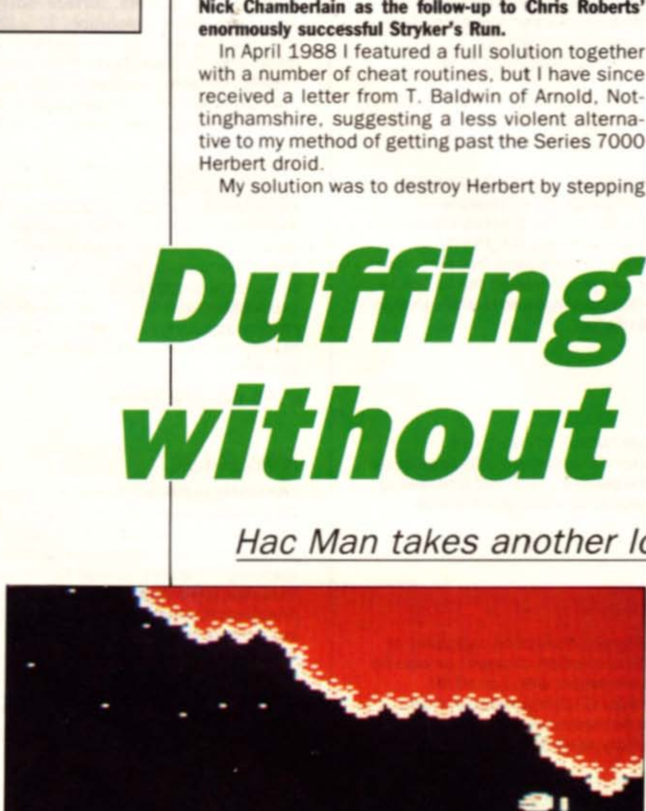
I AM going to concentrate on four old favourites this month, games that are as different from each other as they were from the others on the market when they first hit the streets. One of the most popular in recent times has been Superior's Codename:Droid, written by Martin Edmondson and Nick Chamberlain as the follow-up to Chris Roberts' enormously successful Stryker's Run.

In April 1988 I featured a full solution together with a number of cheat routines, but I have since received a letter from T. Baldwin of Arnold, Nottinghamshire, suggesting a less violent alternative to my method of getting past the Series 7000 Herbert droid.

My solution was to destroy Herbert by stepping on one of your own mines, dropped next to him. The disadvantage of this technique is that you will inflict quite a degree of damage on yourself, so you have to make sure that your suit energy level is quite high before you walk into the mine.

T. Baldwin's alternative, however, is more satisfactory since you don't take any damage yourself. After you have collected the key from Sector Two of the crew's quarters and opened the doors to the jetpack, return to Sector One of the crew's quarters. Dispose of the two Volgan guards between you and Herbert, then simply walk into him and you will hear a ringing sound.

Now go back to the far left-hand side of the crew's quarters and pick up the remote control unit. When you return to Herbert you will find the fallen section of metal pipe that was previously blocking your way has moved back into the pipe above your head, and that the passage to the second chest is now open. Obviously this solution is better than my own, and I am glad to see that there is more than one way to get past Herbert.



Codename: Droid – entering the complex

I am sure that the Mad Hatter would agree that really good adventure games – either text or arcade – should allow you to experiment and should not continually set problems that require you to supply just one solution before you can progress further.

Even though choosing the wrong solution to such a multiple-choice problem may generate trouble later on, a game with this flexibility encourages imagination.

As I mentioned, the April 1988 column featured cheat routines that provided a fairly comprehensive set of pokes for the BBC Micro cassette and disc and Master Compact disc versions of Codename:Droid. I thought at the time they were fairly comprehensive, but I have since acquired three more – infinite jetpack energy, jetpack on demand and – would you believe – no Volgans.

Before adding any of the these new pokes

5.25in disc owners should first enter:

```
231 .i
240 JMP &7700
```

then save this new version of the routine as the definitive one. In its previous form the poke routine for the 5.25in disc would not allow any pokes to be added to it.

The infinite jetpack energy poke was written by yours truly not long after the April 1988 issue went to press, but I had not got around to doing anything with it. Cassette and Master Compact users should add the line:

```
192 LDA#&19:STA &1259: \ infinite jet-pack
```

If you have the 5.25in disc add:

```
232 LDA#&19:STA &1A59: \ infinite jet-pack
```

The *jet-pack on demand* poke was written by Steven Atkins of Warrington, Cheshire and gives you a jet-pack whenever you press *J*. Cassette and Master Compact users should add the line:

```
194 LDA#&C6:STA &385E:LDA#&C2:STA &385F:LDA#&EA
:STA &3860:\ jet-pack on demand
```

And for 5.25in disc add:

```
234 LDA#&C6:STA &405E:LDA#&C2:STA &405F:LDA#&EA
:STA &4060: \ jet-pack on demand
```

The No Volgans facility was provided by Simon Heather of Bunbury, Cheshire, known more recently for the Archimedes game Fireball. This strikes me as being a little extreme, but I have included it for completeness. Cassette and Master Compact users should add the line:

```
196 LDA#&A9:STA &27A3:LDA#&10:STA &27A4: \ no V
olgans
```

while for 5.25in disc include:

```
236 LDA#&A9:STA &2FA3:LDA#&10:STA &2FA4: \ no V
olgans
```

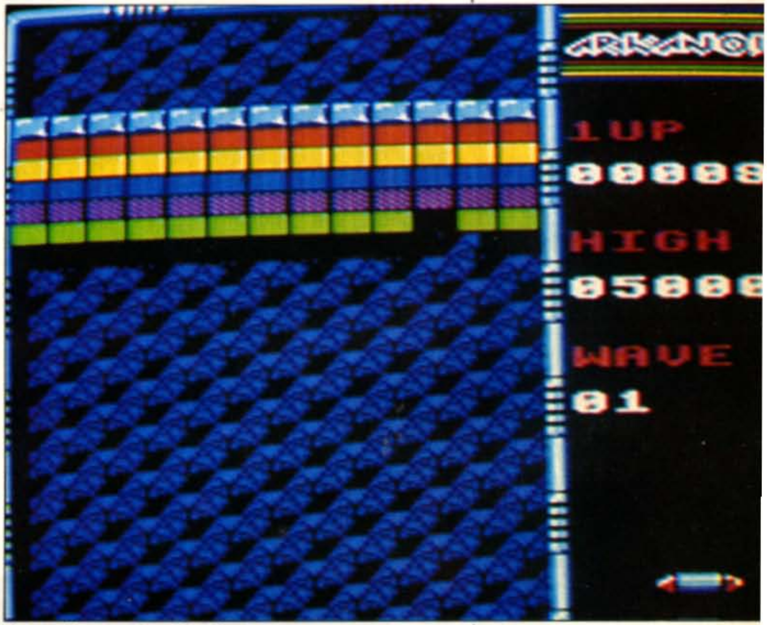
The poke routines which appeared in the April 1988 column were written for the original versions of Codename:Droid, not for those that appeared on Play It Again Sam 2. When games are re-released on compilations the loader programs are often rewritten and pokes written for the original may no longer work.

When I heard of Codename:Droid's imminent re-release on Sam 2 I assumed that this would be the case. However, I have since received a letter from Chris Speight of Loughborough, Leicestershire, who says that David Blackburn's 5.25in disc pokes work perfectly on his 5.25in disc version of Play It Again 2. I have checked them out myself – including the three new additions – and they do.

I have not yet been able to check the cassette/Master Compact poke routine with either of the equivalent Sam 2 versions of the game, but I will do so as soon as I can. Meanwhile, to judge from the 5.25in disc, matters look hopeful.

Arkanoid enhancement

Regular readers may remember the infinite lives poke for the cassette version of **Arkanoid** that appeared in September 1988. However, I have since noticed that this routine would not work because the very last line of the correct program was missing from the published routine. As printed, the program came to a stop as soon as it was run without attempting to load from the Arkanoid tape. The missing line should read:



Arkanoid – break out battle

```
100 CHAIN""
```

On the same subject, I've received a letter from Phillip Massey of Basingstoke, Hampshire, who says that the poke requires very little modification to make it compatible with the disc version. Phillip says that you should type in the original cassette poke exactly as published, then add a new line 90 to prompt the player to insert the Arkanoid disc in the drive and press any key:

```
90 PRINT "Please insert Arkanoid disc and p
ress  any key";:A%=GET
```

As with the cassette version, you should add a line 100 to load the Arkanoid game code and in this case it should be:

```
100 CHAIN"ARKNOID"
```

Save the complete routine on one of your own blank discs, then type RUN. Insert the Arkanoid

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◀ From Page 47

disc as prompted, and press any key. The game will load and you now have infinite lives.

If anyone missed the original cassette poke, the complete routine – with Phillip's modifications – is as follows:

```
 10 REM Arkanoid disc infinite lives
 20 REM by Simon Burnand and Phillip Massey
 30 REM (C) The Micro User
 40 :
 50 P%=&9C0:[PHP : PHA
 60 LDA #&EA : STA &171C : STA &171D
 70 PLA : PLP : JMP !&220
 80 ]:?&220=&C0:?&221=9
 90 PRINT"Please insert Arkanoid disc and pres
s  x/ key";:A%=GET
100 CHAIN"ARKNOID"
```

Soft-soap treatment

Stephen and Michael Youell, of Sandy, Bedfordshire, have sent in a cheat routine that makes **Bonecruncher** much easier to play. It provides infinite lives and almost total invulnerability. It also allows you to select the required number of lives – up to 255, which should be enough – and gives your friend Fozzy infinite energy.

Invulnerability is particularly useful if you really want to cheat properly. Monsters cannot harm you, moving Glooks will not kill you and trapdoors disappear when you walk over them. You need only watch out for any passing arachnids – we mustn't make it too easy.

The cheat routine works equally well on the stand-alone 5.25in disc version of Bonecruncher, the Play It Again Sam 7 disc and the stand-alone Master Compact disc. I have not been able to check the routine on the Bonecruncher that appears on the Master Compact disc version of Play It Again Sam 7, but perhaps a reader might be able to plug this gap? Anyway, the cheat is as follows:

> “You need only watch out for any passing arachnids”

```
  10 REM Bonecruncher cheat
  20 REM for original 5.25in version
  30 REM Play It Again Sam 7 5.25in version
  35 REM and original Master Compact disc
  40 REM by Stephen and Michael Youell
  50 REM (C) The Micro User
  60 REM
  70 MODE 7
  80 osargs=&FFDA
  90 A%=0:X%=&70:Y%=0:?&84=USR(osargs)AND &FF
 100 FOR I%=&80 TO &82:?I%=1:NEXT
 110 PRINT "Infinite lives? "
 120 G$=GET$:IF G$="Y" THEN ?&80=0
 130 PRINT "Infinite energy for Fozzy?"
 140 G$=GET$:IF G$="Y" THEN ?&81=0
 150 PRINT "Invulnerable to Glooks and monste
rs? "
 160 G$=GET$:IF G$="Y" THEN ?&82=0
 170 INPUT "No. of lives (1-255)? "A
 180 IF A<1 OR A>255 THEN 170
 190 PRINT "Please insert Bonecruncher disc
and   press any key";:A%=GET
 200 ?&83=A
 210 MODE 5
 220 IF ?&84=8 $&100="LOAD BONE2 1E00":Y%=1:X
%=0:CALL&FFF7 ELSE *RUN BONE2
 230 IF ?&80=0 THEN ?&3653=&A9
 240 IF ?&81=0 THEN ?&3AD0=0
 250 IF ?&82=0 THEN ?&35C3=&A9
 260 ?&3527=?&83
 270 *RUN BONE2LD
```

Cholo calls for lateral thinking

Firebird's disc-only **Cholo** caught the imagination of many readers of *The Micro User* when it appeared on the scene a couple of years ago. In spite of its relative age, I am sure that it will still have the same impact on any BBC Micro owner who may have missed it when it was first released, because nothing quite like Cholo has been seen since.

For anyone who does not know the game, Cholo offers a finely-balanced combination of an explore-and-collect adventure and arcade-style action that often requires very nifty fingerwork to get you out of trouble. It is set in an apparently deserted war-scarred city, displayed in Elite-style wireframe 3-D. However, you quickly discover that you are not alone.

Like any other adventure, Cholo does have a solution, albeit a very convoluted one. Readers who have completed it will certainly remember the firework display that acclaimed their success, and N. Sharratt of Burton on Trent Staffordshire has news of a method that allows you to recreate this finale. Simply enter the following lines:

```
MODE 6
*LOAD O.X
CALL &4E75
```

Although anyone could use this short-cut to sneak a preview of the finale, I would strongly recommend resisting the temptation if you have not completed the game. It would rather spoil the effect.

The design of Cholo features a high degree of humour that will particularly appeal to film buffs, and to those of computing or scientific persuasions. The approaching summer is making me feel generous, so I will offer a free copy of the game to the first reader who can correctly explain the following names and passwords used in Cholo:

Rizzo the Rat
Anneka the Flying Eye
Klaatu
Ridley the Camera
Fellini the Camera
Aviata
Alan M. Turing
Manic Mine
Igor the Hacker
Lorean

Incidentally, you do not need to have played the game to be able to supply a correct set of answers: Just apply a bit of lateral thinking. If you've already got Cholo and feel like having a go I'll hold back a copy of Maltese Joe's Pool Challenge for you.

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CEEFAX Guide

B B+ M

Software is currently transmitted for a period of one week. Files are available from Friday afternoons to the following Thursday evening, with the exception of the Issues teachers' notes which, due to their topical nature, are available from the Wednesday morning to the following Tuesday evening during the week of transmission. The details are provisional only.

June 9 to 15

ATSCal Dumps

There is now no need to buy calendars year after year – this handy routine will print them out for you. After automatically finding the current date from Ceefax, you choose between this year's, next year's, or last year's calendar in any of three different styles and several sizes.

!Boot Hz/B Hertz/T
Hertz/B Hertz/D

Turn your BBC Micro into a frequency meter using its own internal clock, finely tuned by software for accuracy. Electronic signals with a frequency range of up to 250KHz can be fed into the user port and monitored by the micro.

Dominoes

This is a fascinating routine from the May issue of *The Micro User*. It lets you design patterns on the screen and – with the press of a key – knock them over like dominoes.

Scene28 ALevBio ALevHis

Notes for the current schools programmes Scene, A level studies – Biology, and A level studies – History.

T/ATS06 ATSDPO

Details for owners of the Advanced Teletext Receiver – or BBC Teletext Adaptor – describing how to write your own software to bypass the ATS rom and access the teletext transmissions directly. Part 6 explains the structure and encoding of the TSDP – Television Service Data Packet – which carries a range of details about the television and teletext services currently being received.

June 16 to 22

Texrom

Here's a superb utility to sit quietly in your micro waiting to be called. Texrom is a screen dump with a difference – many parameters may be specified. For example, text only, graphics, graphics with tone colouring, variable size and a super three option where the last three selected screens are printed side by side in the width of an A4 sheet.

Yahtzee

Here's an excellent implementation of the popular dice game. It was first published in the May issue of *The Micro User*.

QSDemo QSText

There are many applications for sort routines and algorithms that can be applied. This superb demonstration clearly shows the principles involved and exactly what happens at every stage in the commonly used quick sort procedure.

Break T/Break

Have you ever accidentally pressed Break and lost all your hard programming work? Well here's the solution. This routine will protect your software from corruption and restore the program and variable values if Break is pressed.

T/ATR07 ATSDP2

More from the series explaining how to access teletext broadcasts directly without the need to go through the ATS rom. This week's module looks at the type 2 TSDP, an experimental teletext service designed to provide details of the current television programme to video recorders so they can automatically turn themselves on and off at the correct times, even if the broadcasts are not running to time.

June 23 to 29

Echoes !Boot Echinf
Tokens Link Add
Vars Data Code

From the forefront of technical achievement comes the intelligent loader. This system simplifies the use of the DFS, making disc operation and housekeeping easier to understand and implement.

Sultan Broken

Are you smart enough to make money from the sultan or make use of a faulty calculator? These two classic style puzzles, designed to tax your central processor too, can be solved in a number of ways. Whichever method you choose, finding the solution is most rewarding. Be careful, however, there is a catch.

Card Index

If you need a simple and effective card index, this routine from the May issue of *The Micro User* should meet your needs.

T/ATR08 ATRCAST

The concluding part of the look at teletext reception using a GIS teletext adaptor. Part 8 outlines the commercial data distribution systems available through teletext.

June 30 to July 6

Midas (9 files)

In this imaginative game you have to seek gold – not any old gold, but the family treasure left to you by a kind relative. Unfortunately, to avoid legal complications, it has been deposited in various bank accounts around the country and your job is to recover it.

B/Capt T/Capt

Give your home videos that professional touch with this elegant caption generator. No more sticky fingers trying to get adhesive labels aligned on a board – let your micro do the work and you do the design. It's easy to use and fully documented, with special facilities for synchronisation.

Soundex

This useful routine from the May issue of *The Micro User* can trap spellings that are almost correct. Used as part of your own programs, near answers like Pascull can generate a *right but spelt wrong* response – rather than *wrong* – when the correct answer is Pascal.

U·P·D·A·T·E

Schools shine in business competition

THE first Young Business People of the Year competition which is aimed at prompting computer assisted learning in schools, has been voted a resounding success.

Throughout the country, 500 sixth formers started out on the competition and have now been reduced to five teams which will vie for a first prize of £5,000 at the finals to be held at the London headquarters of the Institute of Chartered Accountants on June 30.

The man behind the competition, Professor Ronald Brech, told *The Micro User*: "We have been very impressed with the schools that have taken part. The judges agreed that if these are the young people in whose hands the country will be then we need have no worries.

"The purposes of the competition is not to win cash prizes but to encourage schools to switch over to computer assisted learning. The average scores in the regional rounds were 50, but in the semi-finals it was 250. It is obvious that the competition has promoted learning".

Sponsored to the tune of over £12,000 by catalogue retailer Argos and accountants Coopers & Lybrand, the competition is based on business simulation Beat the Boss from RBRC Software. Players in teams of four have to operate a fictitious company for five years and the winners are those with the highest score or largest true profits.

Thirty six schools took part in this year's competition. They will be increased to 60 next year and then to 120. Six regional winners have received £250 each with six best losers receiving from £200 down to £100.

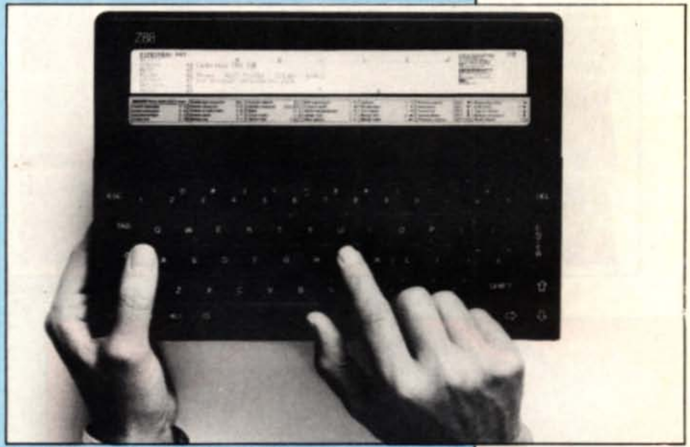
The winning school will receive £5,000 with £3,000 for second place, £1,000 going to the third and £500 to the national runner-up.

Top team in the recent semi-finals was Penglais School, Aberystwyth with a score of 542. Other finalists are Royal Grammar School, High Wycombe; Raynes Park High School; Bradford Grammar School; Richard Taunton School, Southampton; and St Paul's, London.

Portable link to BBC Micros

SHROPSHIRE education authority has voted in favour of the Cambridge Computer Z88, aiming to put at least one and possibly two machines into each of its 220 junior schools.

It already has more than 100 Z88s and is now trying to persuade Cambridge to develop a portable specially designed for education.



Cambridge wants educational Z88

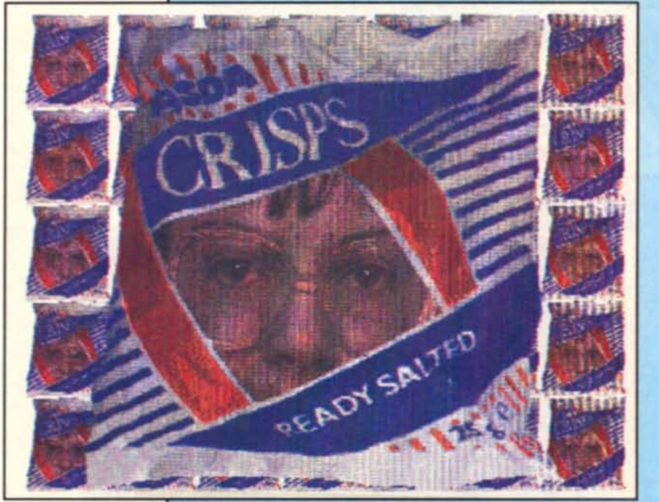
"We are an authority that supports the BBC Micro and we wanted a portable which could be used with them", said project manager for Shropshire LEA Mark Klecot. "We like the concept of a portable because it allows children to put in data immediately.

"In science experiments they can use the micro as they do the work. If they have to break off and go to a workstation, they can sometimes forget what they have done. The Z88 is also useful on field study work and for children with special needs. What we are looking for now is a new member of the Z88 family, a portable specially designed for education. If someone came up with that kind of machine it would have a big market".

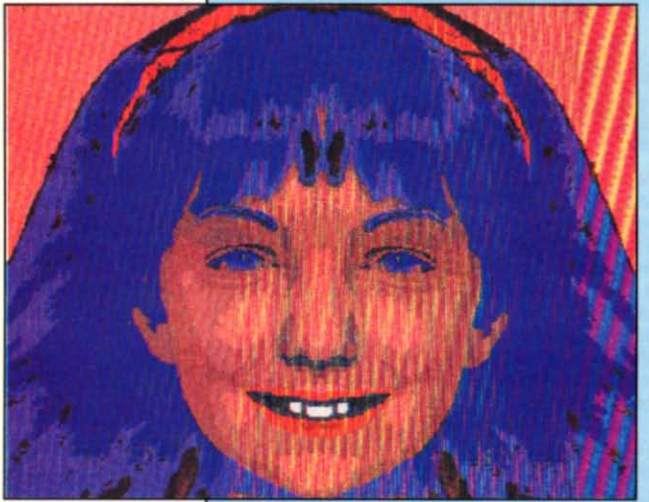
Management crises come on disc

TWO new versions of the business training program Crisis Management have now been brought out by RBRC Software (01-946 8641). Like previous ones they involve running Fothergale Ltd, makers of disposable Castaway shirts over five years with both self-generated and computer-injected crises.

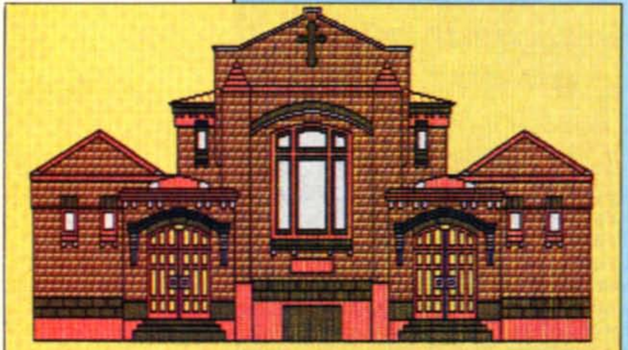
The team version incorporates group dynamics and includes playing and teaching guides with manual for £57.05 plus £4.50 postage and packing. For single players there is the open learning package priced at £39.67 plus £2.50 postage and packing. Both cover six decision areas – marketing, production, supply of raw materials, delivery, investment and organising manpower. They are available from RBRC at The Guild House, 32 Worple Road, Wimbledon, SW19 4EF.



More advanced work



Handling digitised images



Simple colour fills

Product: Pro-Artisan
Price: £169.95 (Education discount available)
Supplier: Clares Micro Supplies, 98 Middlewich Road, Rudheath, Northwhich, Cheshire, CW9 7DA
Tel: 0606 48511

PRO-ARTISAN is the follow up to Clares' very successful Artisan. It comes as a two disc package with a very clear, well laid out and illustrated manual which covers all the options available with a series of 23 exercises. The nature of the package is such that options can be combined to produce special effects, many of which have not been documented and may only be discovered by extensive investigation.

Output is vital on a product such as this, and the package contains drivers for Epson and Brother printers, Hewlett Packard compatible laser printers and paintjet printers as well as ones for the normal Integrex 132 – small, standard and double size – Xerox 4020 colour ink jet printers, and the Integrex Colourcel.

The *Configsys* file can be used to load the printer driver you want by default when starting up the program. Pro-Artisan boots as normal but takes a while as it saves the current configuration and sets up the micro to leave the maximum amount of memory available for sprites.

Pro-Artisan follows the same format as Artisan with the main developments in the use of a Fill sub-menu to allow spherical, horizontal and vertical graduated fills in user-defined banded or continuous shading. The rest of the Paint menu is very similar to that of Artisan except that it offers a fixed 256 colour palette which can be called up at any time.

One of the most useful tools is the Wash or anti-aliasing option. This allows you to blend or smudge the edges of an object or wash over parts of the screen giving a watercolour effect.

This is seen most effectively on the picture of the dodo on the support disc which is included as part of the package. It's well worth spending time looking through this as it gives a good idea of what can be done as well as giving you ideas of where you might start with this very comprehensive package.

Another new concept introduced in Pro-Artisan is that of the key colour. It takes a bit of time to get the hang of, but is a powerful tool once mastered. In the Sprite and Cut & Paste menu it acts as a transparent colour as it did in Artisan. When used in the Draw menu the key colour is used to select the colour that the air brush will spray on to without spreading to the rest of the picture. Under the Fill sub-menu it can be used to set boundaries to flood-fill up to or inside of permitting you to fill into a multicoloured background.

Another new feature under the Fill sub-menu is colour sets, groups of 8, 12 or 16 colours ranging from light to dark which are used to give the realistic shading effects of the graduated fills. It is the emphasis on these ranges of colours which has determined most of the set of 256 colours chosen for use in Pro-Artisan at the expense of

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Steve Bruntlett teaches Art and Design at Honley High School in Huddersfield and has been using Pro-Artisan in his teaching for six months.

The professional touch

Steve Bruntlett looks at what a new art package can achieve

some of the kinds of user-defined shades previously available in Artisan.

This means in practice that when you convert Artisan screens the flesh tone is not found and reverts to white. If you've changed the palette on Artisan and then convert it there's a good chance that some of the colours will be different. Having said that, the use of colour sets produces very realistic spherical or cylindrical objects as well as good aerial perspective effects in landscape images. There are 19 colour sets and provision to define and save to disc a further four of your own.

There is also a Sprite fill option which floods single colour areas with the currently selected sprite. This is also used in the more sophisticated Distort option of the Tool menu. To fill any shape with a single colour all you need to do is to fix the ends of a straight line anywhere within the shape and Pro-Artisan will distort the sprite horizontally to fill the shape on either side of your line up to the edge of the shape. This is a powerful tool and can be seen in use in the picture of the bowl of fruit on the support disc.

The Banding menu has been similarly extended to include gridlock and a further sub-menu for Bezier Curves. The former allows you to define an invisible screen grid where specified points automatically move to the nearest grid intersection. The Bezier Curve sub-menu allows you to produce accurate outlines for masking sprites or outputting to a laser printer.

The Sprite menu has been extended from being able to pick up a rectangular area of the screen to being able to pick up a cut-out irregular part of the screen with or without a single colour mask of the same shape and size.

Once either type of sprite has been grabbed it can be rescaled on screen before fixing its position so you can see exactly what you're doing. The other improvement here is that when saving or getting sprites from memory – now called the Sprite Store – you can see the sprites displayed in a window.

The Toolkit menu has been extended to include a global magic brush, a global colour set change option, a text editor, a printer dump and a command line window.

The global magic brush is a really useful development from the one supplied under the Paint menu. If you try to change black to white and vice versa simultaneously using the normal magic brush a lovely op-art black and white rectangular texture is produced. This can be used to texture areas of the screen but completely ruins any detail. The global magic brush simply inverts black and white wherever it is found in a defined portion of the screen.

Colour set change can be used to alter a selected area to the currently selected colour set. If this ranges from black through greys to white the result will be a monochrome version of your original. Superb sepia-toned effects can be achieved using the second colour set.

The text editor is really a character editor allowing you to create or edit characters to produce corners or elements of fancy borders. More fonts are available than with Artisan, including a small font of the same size and shape as the text used in the Help window and a set of corners and decorative characters.

● *That's the end of our brief run through of what Pro-Artisan is capable of. Next month we'll look at how it's been used as an educational tool.*

About Artisan

Artisan is a 16 colour art package released by Clares in late 1987 and was reviewed in the January 1988 issue of *The Micro User*.

Words from the wise

A package spreading literacy as a charitable activity is examined in-depth by Rog Frost

Product: Wordwise Plus Literacy Pack Price: £35.65 or £58.65 with Wordwise Plus chip
Supplier: Scetlander, 74 Victoria Crescent Road, Glasgow G12 9JN.
Tel: 041-357 1659

ADULT literacy has rightly become quite an in thing these days. The Wordwise Plus Literacy Pack has been produced to support work in this field and starts with an impressive set of sponsors and backers including the Training Commission – which supports the Open Technologies scheme – and Special Needs Software Limited which publishes the materials.

The pack consists of a tutor's booklet, a book of reference cards, Wordwise Plus tutorials in the form of a flip-over easel pack and six floppy discs. Each has a card folder of advice and instructions for use. It certainly looks an impressive bundle for the money, particularly if you opt to get the Wordwise Plus chip as well.

Open Technology tutors are expected to be able to help adults with literacy problems, and there can be no doubt that the use of a word processor could be beneficial. However, these tutors are not expert at everything and the well-written manual starts by giving advice on where tutors should begin according to their previous experience.

Beginners get all the help needed with tasks such as handling floppy discs and the importance of back-up copies. It's a shame that the document on fitting roms has been written in computer jargon. This is the weak link in the instructions for tutors although one of the reference cards gives extra help.

Perhaps the best part are the short case studies, which should help new tutors to have confidence even if they feel unsure with micros and word processors themselves. The glossary of jargon and other terms will also be of great use to many.

The superb tutorial easels provide an excellent system for learning the ins and outs of the Wordwise Plus system. It runs from absolute basics, such as switching on, right through to advanced features such as editing segment programs.

The reference cards are well researched and written. There are 50 covering tasks such as how to create and use boot files, advice on layout of work and paragraphs and many aspects of printing out.

I have never been a Wordwise user – I have always preferred a more *wysiwyg* display – but these support materials with the literacy pack could make a Wordwise Plus user of almost anybody.

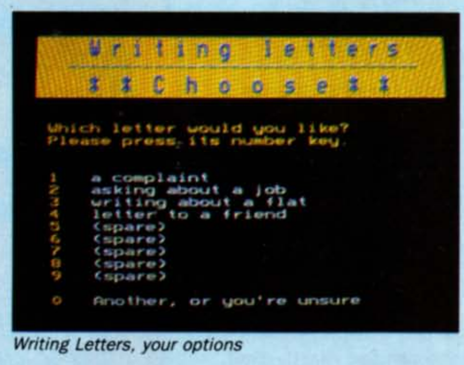
The six discs contain programs written in the Wordwise Plus programming language, which means that the chip must be installed. There is no specific order and, indeed, the instructions all emphasise the need for tutors to dip into appropriate materials.

The first disc contains two programs, Flash and Define. The former allows the screen to be used to display flash cards under the control of the user. There is a small collection of words on the disc as an example, but it is very easy for tutors to create their own.

Define is a sort of hangman game where you have to guess a word. A clue is given but basically it is a case of guessing letters. Once again, there is a sample file but it is easy to create your own.

Disc two contains Jumbler and Compound. The first, **Jumbler,** allows the tutor to create files of words which can be displayed in anagram form for the student to order. This idea is extended to jumbled sentences which can be sorted, and the final level involves sets of sentences which need sequencing.

Compound aims to help with spelling words of more than one syllable. Words can be displayed broken up into separate syllables and students can also select suitable prefixes or suffixes to complete part words. As usual, there are sample files but the disc folder gives advice on creating your own data.



```
Writing letters
** Choose **

Which letter would you like?
Please press its number key.

1    a complaint
2    asking about a job
3    writing about a flat
4    letter to a friend
5    (spare)
6    (spare)
7    (spare)
8    (spare)
9    (spare)

0    Another, or you're unsure
```

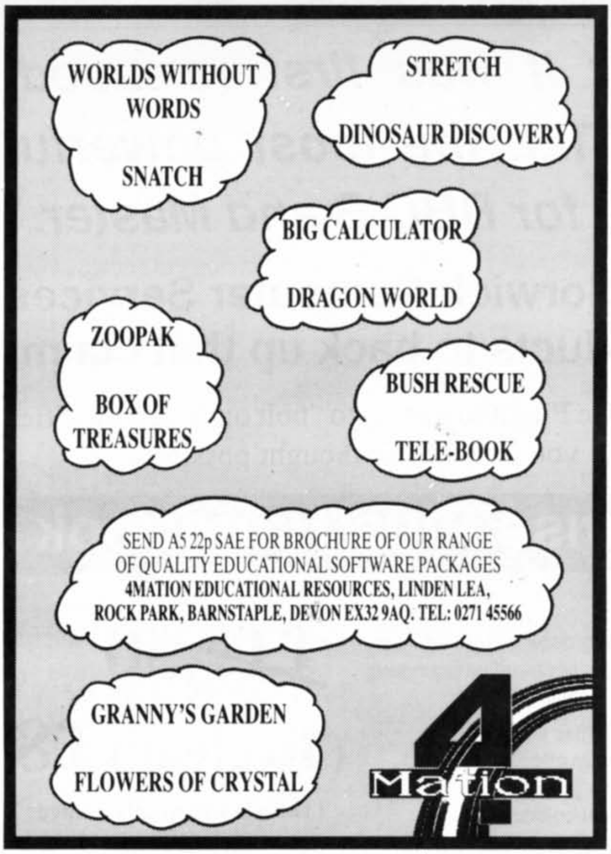
Writing Letters, your options

Cloze on disc three allows tutors to create cloze tasks suitable for their students. I felt that this was not too well implemented with its option to remove, for example, every fifth word from the text. There is a slightly more complicated way of removing specific words from the passage and this makes far more sense as a cloze activity.

I booted **Stripper** from the same disc with anticipation. But instead of a Page Three girl I was presented with a program for removing individual characters such as spaces or full stops from a piece of text so that a student could put them back again.

Writing Letters could be used as a way into word processing and there are sample files for various

Turn to Page 57 ▶



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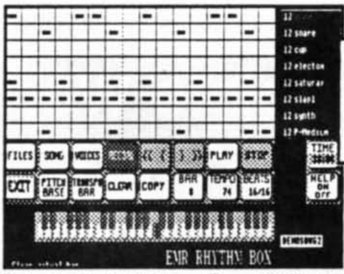

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◄ *From Page 54*

types of letters including complaint, friendly and job application. These all contain the basic structure leaving gaps which need filling in. The disc folder gives full advice to tutors on creating similar structures, disc filing and printing.

Test and **Assess** works in a similar way to the letter writing disc and allows tutors or students to create multiple choice quizzes or questionnaires. These could then be used by as many people as possible and their answers can be analysed.

The final disc contains word processing exercises – which run alongside the Wordwise Plus tutorial material – and a library of other text files. Some of these are of direct use to a tutor, a list of useful addresses for example, while some might be used by students – such as a letter explaining a child's absence from school.

A number of the discs have a routine called Flipside. This is a direct – Shift+Break – route to Wordwise Plus edit mode with suitable amendments such as a slowed down key repeat rate. These discs also provide space for student files.

Cheap though the package is, it is possible for people genuinely involved in adult literacy to obtain a free pack provided they can give good reason why they should have one. This offer has been made possible via a charity, so please don't waste time by writing for a pack if you have no direct need for it.

I am impressed with the range of possibilities offered here. Most could be classed as drill and practice exercises but these are very useful for people with writing difficulties no matter what their age.

Summing up

It's impressive to find that Wordwise Plus is able to handle such a variety of teaching activities. The package is cheap and makes very good use of a very common word processor. On the negative side it has a very specific use, that's to say it's not context free, so you should really need it before getting it.

Maths gets into top gear

David Marshall dons his racing kit to investigate a mathematical simulation

Product: Cars – Maths in Motion
Price: £27.60 (BBC) £34.50 (Archimedes)
Supplier: Cambridgeshire Software House, The Town Hall, St Ives, Huntingdon, Cambridgeshire PE17 4AL.
Tel: 0480 66805

ONE of the best pieces of simulation software, especially if your main interest is maths, is now available for the Archimedes as well as the BBC Micro. Cars – Maths in Motion requires children to prepare a car to take part in a Grand Prix race.

The children are split into teams and each must adjust their car to suit the circuit on which they will be racing. They must also devise practice lap and race strategies, basing decisions on a variety of information presented to them, their own findings and measurements of the plans of the various race tracks provided.

This estimating involves working out the optimum speed for every bend, turn and straight on the course. Groups compete to achieve the fastest practice lap in order to gain pole position on the starting grid. They then devise their race strategy including fuel loading, tyre types, when to take a pit stop. They must bear in mind the length of the track, expected lap times and the dreaded weather forecasts.

Climax of the program is the race day, bringing the excitement of a Grand Prix into the classroom as the teams discover for the first time, the opposition's tactics and learn the success or failure of their own.

The excellent handbook suggests that "the program augments the understanding of percentages, multiplication, division, simple geometry, scale drawings, straight line graphs, strategy and the use of planning and logical thinking. It also provides an ideal base for a wide range of scientific experiments".

Several of the ones suggested relate directly to the work involved in the project and are detailed in the booklet. They come under the headings of Streamlining, The Motor, Gears, Aerodynamics, The Effects of Friction, and Suspension.

These are sensible, practical science lessons that all children could and should, be introduced to. I also liked the program-related classwork suggestions that include history, mapwork, roads, transport and a lot more besides.

The handbook for Cars – Maths in Motion finishes its introduction with: "Using this program, the children will begin to appreciate the power of mathematics as a means of providing effective solutions to problems. In essence, this program aims to demonstrate that science and mathematics can be both useful and fun".

I can honestly endorse everything it says – this is just the sort of program the Archimedes, or any other micro, should be used for.

Summing up

This program illustrates well that maths has a practical application. And it's an ideal addition to any software library.

Six of the best

Marshal Anderson evaluates the latest batch of software from Cambridge

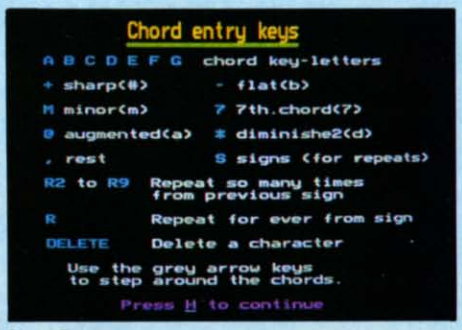
Product: Chord Processor
Price: £14.95
Product: On the House
Price: £20.70
Product: Maths in Space
Price: £18.40
Product: Addition and Subtraction of Fractions
Price: £16.10
Product: Subtraction ... Hundreds, Tens & Units
Price: £12.65
Product: Class Organiser
Price: £16.10
Supplier: Cambridgeshire Software House, The Town Hall, St Ives, Huntingdon, Cambridgeshire PE17 4AL.
Tel: 0480 66805

CHORD Processor is an interesting package that allows chord sequences to be created, edited, transposed, played back and saved for later use. At first sight this seems the sort of thing that requires a fair knowledge of music but in fact this is not the case. The program is capable of dealing with major, minor, seventh, augmented and diminished chords and if this means nothing to you fear not, someone has already done the hard work for you.

Most primary schools have a collection of music books with popular songs and guitar chords printed above the music – just the thing for the completely musically illiterate to type straight into Chord Processor and get some sort of tune played straight back.

The chords are easily entered on to an editing screen which gives full cursor movement with insertion and deletion. Loops, which can easily be set up for repeats, may be nested – here we see the meeting of music and Logo-like programming ideas.

Tempo has nine options and the rhythm is set from a menu which groups beats in two, three, four and five time so it's just a matter of looking at the numbers at the start of the music and selecting the relevent option. Each chord entered represents one beat, so three or four will have to be entered to fill the bar the guitar chord usually represents. You soon get used to this.



```
              Chord entry keys
A B C D E F G  chord key-letters
+ sharp(#)         - flat(b)
M minor(m)         7 7th.chord(7)
@ augmented(a)     * diminishe2(d)
, rest             S signs (for repeats)
R2 to R9   Repeat so many times
            from previous sign
R          Repeat for ever from sign
DELETE     Delete a character
   Use the grey arrow keys
   to step around the chords.
          Press H to continue
```

Chord Processor

Other options include a simple drum beat, with three possible sounds to accentuate the start of the bar, and a tuning utility. Instrumental sounds available are piano, organ, vibes and chimes. The vibes sound is difficult to cope with, but the other three are pleasing and the main difference between them lies in the amount of their sustain.

Using different instruments creates very different effects on the chords you have written in. A slow piece will benefit from the way the organ sound continues smoothly over rests, the piano sound is short and percussive for bright up tempo music and the chimes is an effect somewhere between the two. Three octaves are on offer along with four different arpeggios which are useful for instrumental work but rather intrusive when used with voices.

The upshot of all this is that teachers and children have a tool which sets up an accompanying piece for their favourite music. The system's simplicity was shown when a group of 10-year-olds programmed accompaniments to Nowhere Man, A Little Help From My Friends, Clouds and Rainbow Connection within an hour of being introduced to the program.

There is, of course, more to it all than that. This kind of package is simple enough to lead children down the path to composition in the same way that a word processor encourages them to experiment with language. Used in conjunction with other aids, like electronic keyboards, it will further expand the musical horizons of many.

The accompanying teacher's notes are somewhat perfunctory. There are no suggestions as to how the program might be used, and a more extensive guide regarding what to do with chords not available on the processor would have been welcome.

The more experienced musician will probably find this package limiting – one beat is the smallest time unit and the chord types are necessarily limited by the BBC Micro's three sound channels. There are only four instruments and only one can play at a time – but it is exactly these limitations that allow the program to be used by those less confident in music.

Tricks of the trade

BUILDING a house is a complex and difficult task, not only in terms of the skills of the workers who do the job, but also in the actual organisation of people and materials. **On The House** is a sequencing program that divides the task into 10 sections and first asks the student to set the tasks in order.

While no one is going to have trouble spotting that the foundations must be laid before the roof can be put on things get trickier when asked whether second fix internal fittings come before or after plasterboard ceilings and walls. Once things are in order, the tasks must have assigned to them time, workers and materials. This in itself is no small task: There are 13 different trades and 20 materials to choose from, and an error at any point will cause problems.

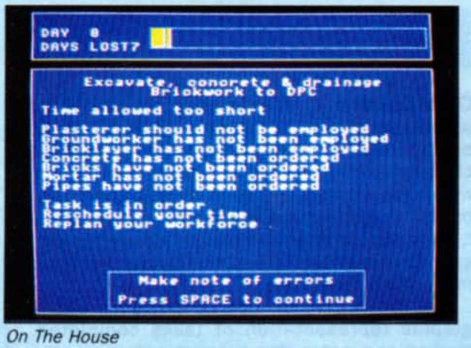
Having planned the schedule of work, the program then runs through the sequence to see if the house can be built in 100 days or less. At each stage progress so far is shown graphically and the simulation runs until it finds a problem. At this point the task in hand may be edited to get building underway again, but the time wasted is recorded and it needs very few gaffs to take the task beyond the time limit.

If things get too easy for a given group there is the optional addition of random hazards like weather and building inspectors to spice things up.

The whole program is thoughtfully put together inasmuch as it keeps frustration at bay by letting you edit those bits that are wrong rather than making the whole thing start again from scratch. All instructions given are recorded on a building file so that the simulation can be run over a period and there is the facility to print out the schedules at any point.

The keen-eyed pupil will see that the program may be completed with a combination of trial and error and the students' notes provided – as a sequencing/comprehension exercise that's no bad thing.

Many teachers, however, will want to spend a lot more time having the pupils do their own research as to the needs of the task, and to this end it is slightly disappointing to find no book references or useful addresses in the teachers' notes, though there are plenty of ideas there for further work.



```
DAY  0
DAYS LOST7

        Excavate, concrete & drainage
              Brickwork to DPC
Time allowed too short

Plasterer should not be employed
Groundworker has not been employed
Bricklayer has not been employed
Concrete has not been ordered
Bricks have not been ordered
Mortar has not been ordered
Pipes have not been ordered

Task is in order
Reschedule your time
Replan your workforce

            Make note of errors
          Press SPACE to continue
```

On The House

This program will doubtless have applications in many areas of education from top juniors to BTEC and, as with any good simulation, the most important work is done away from the micro.

Multiplication maze

MATHS In Space is a bit of fun that will have uses in many classrooms. It's a simple arcade adventure that places the player in a maze. Some of the walls may be passed through by answering multiplication table questions and the player gains points by moving about like this. To add interest there is a guard – at first invisible – who will ask several questions in quick succession, capsules to put the guard to sleep, electronic eyes to show where the guard is hiding, jet packs to fly over walls and star crystals to multiply the score.

The player moves up through 10 levels in the maze – at each the questions get more difficult – to complete the escape. The use of an ascending tone helps to raise the excitement level and questions need to be answered quickly. It is very testing.

MATHS
IN SPACE
CSM SOFTWARE
PRESS 'C' TO CONTINUE

Maths In Space

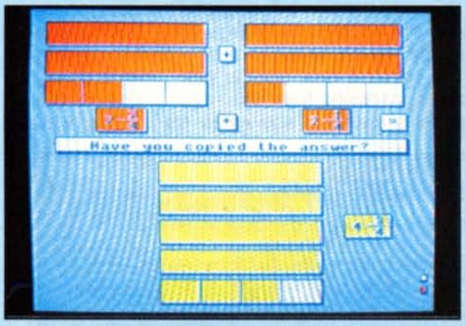
While strategies can be developed here they are fairly straightforward so the program really is just dressed up tables practice. There were some problems using the jet packs: They move the player randomly and are fully capable of landing in an area of the maze cut off from the next level. This caused frustration but, again, strategies can be developed to reduce the risk. That said, the images used are totally non-violent and the player is not killed – the escape is simply ended.

The player's position can be saved during the game and a high-score table keeps the competition going. All in all a simple but very effective package.

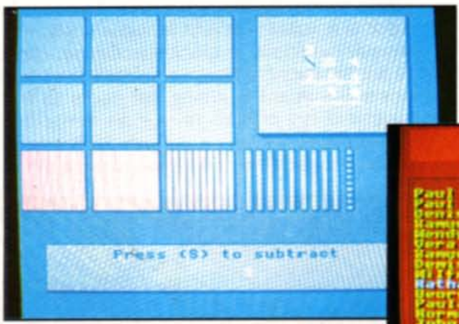
Tackling fractions

ADDITION and Subtraction of Fractions is a useful program which demonstrates graphically those two operations. Coloured bars, very much like the often used fraction strips, are set up on the screen to represent the problem. Children can change the denominator of one side and split a

Turn to Page 60 ▶

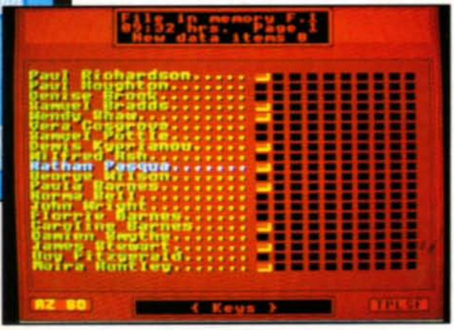


Addition and Subtraction of Fractions



```
Press (S) to subtract
```

Subtractions...Tens & Units



```
File in memory F.1
09:32 hrs.   Page 1
New data items 0

Paul Richardson......
Paul Houghton........
Denise Brook.........
Samuel Bradds........
Wendy Shaw...........
Vera Cosgrove........
Samuel Pottle........
Demis Kyprianou......
Wilfred Ash..........
Nathan Pasqua........
George Wilson........
Paula Barnes.........
Norma Bell...........
John Wright..........
Florrie Barnes.......
Caroline Barnes......
Damien Smythe........
James Stewart........
Roy Fitzgerald.......
Moira Huntley........

AZ 80        < Keys >
```

Class Organiser

◀ **From Page 59**

whole one if necessary before being asked to enter the answer. The program does not solve the problem for the child, it merely displays graphically the operation as they go along.

There are various options for the difficulty of questions, the time message display and whether the program will stop if the child is having trouble. So this is a program about re-inforcement, and at no point pretends to teach: It is set up to be another resource for use by the teacher in explaining what is often a difficult concept to grasp.

Because the aim is so straightforward the program succeeds admirably, with the exception of a rather eccentric yes/no input routine that caused some confusion at the start.

Arabic take-away

IN exactly the same form as the fractions program is **Subtractions ... Tens & Units** and here hundreds are represented by large squares, tens by strips and units by small squares – the familiar flats, longs and cubes.

The child is taken through the problem step by step and is asked if any parts of the upper number needs decomposing and this is then shown graphically along with a copy of what the written sum should look like in a child's book.

Special attention is brought to the case where there are no tens to change into units and a hundred has to be exchanged – a process that many children have trouble with. This is a very helpful package that will, again, add to the teacher's available strategies for dealing with specific skills and their problems.

All three maths programs will draw the criticism that they are drill and practice and as such will be looked down upon by some sections of the profession. Perhaps it is fair to say that there are other things a teacher will want to do with a scarce resource in the classroom but in schools with a flexible and open approach to the use of micros, especially those with a good number of machines or machines dedicated to remedial work, these programs will have a specific and very useful place.

DIY administration

CLASS Organiser is an interesting exercise in the administrative use of micros in school. It is an empty structure into which the teacher places the class list and the tasks that have been set for the week. Having done this each child is given a list of which task he or she will need to complete and a projected completion time. This done the program is able to display and manipulate that information in several ways.

The list of children can be displayed with a graphic representation of tasks completed, marked or overdue, the program running a real-time clock to keep track of this. Children can inform the micro when a given task is finished and see easily what is left to do and how long they have to do it in. The teacher can attach a mark to each task as it is completed, as well as reset the completed flag if he or she disagrees.

The status of individual children or tasks may be printed out at any time and this gives the teacher a powerful tool in the organisation and evaluation of a classroom running an integrated day, to see immediately if a given task is causing all the children problems and if a given child is making headway.

This is an interesting development and many teachers will be anxious to try it out in their own classrooms. But it does have resourcing implications and its use will have to be carefully organised if it is not to intrude upon the other functions of a micro in the classroom.

Summing up

These new programs from Cambridgeshire Software House cover several different topics, but if there's one relevant to what you are teaching it's well worth a look.

L let loose to good effect

Dave Wales and Denny Richardson relate their enjoyable experiences with this mathematical adventure

THE *L* disc-based adventure game, devised by the Association of Teachers of Mathematics, is set in a palace with more than 50 locations. The aim is to rescue Runia, a girl who has been captured by the Drogo robot guards. To achieve this, you must solve many mathematical problems.

It is a very rainy day and here we are sitting in a staff room in a crumbling school. The head teacher is reading the situations vacant column and the class teacher is bored and can't wait for the summer holidays – doom and despondency hang heavy in the air.

HT: *If you're like this now what on earth are you going to be like in September? At least you haven't got the problems I've got.*

CT: Leans forward eagerly, nose twitching. Oh, yes?

HT: *I keep dialling numbers on the telephone and no one replies.*

CT: Call in British Telecom, then.

HT: *Not that telephone – the one that's found on the chest in L.*

CT: L? (Class teacher's eyes light up, rainclouds recede.) Why didn't I think of that before? That's what I'll do with my class in September.

HT: *They're only upper juniors – they'll never manage it.*

CT: Oh yes they will – with a bit of structure and forward planning.

So September arrives:

HT: *All ready for a bit of L then?*

CT: Yes, but I need an introduction which will capture their attention. I don't just want to put them straight on the micro. Somehow, I want them to earn the right to gain entry into the program.

HT: *How about pretending that it's a real palace that they're visiting?*

CT: Yes, they could write letters to the curator.

HT: *And perhaps have to answer a few questions in order to be given an admission ticket.*

CT: As they finish their letters we'll send ...

HT: *We?*

CT: Yes we'll send personal replies to their homes from the curator.

HT: *Spend money?*

CT: Second class and they just might think it's a real palace. We can include quiz sheets. When they've finished them and signed a declaration taking responsibility for their own actions in the palace they can be given an admission ticket which allows them to start.

HT: *They've never heard of Fibonacci – it took me all summer to crack the telephone problem – how are they going to manage it?*

CT: If we give them preparatory worksheets before they reach that stage they'll be all right. Most of the work will be practical anyhow.

HT: *What about follow-ups?*

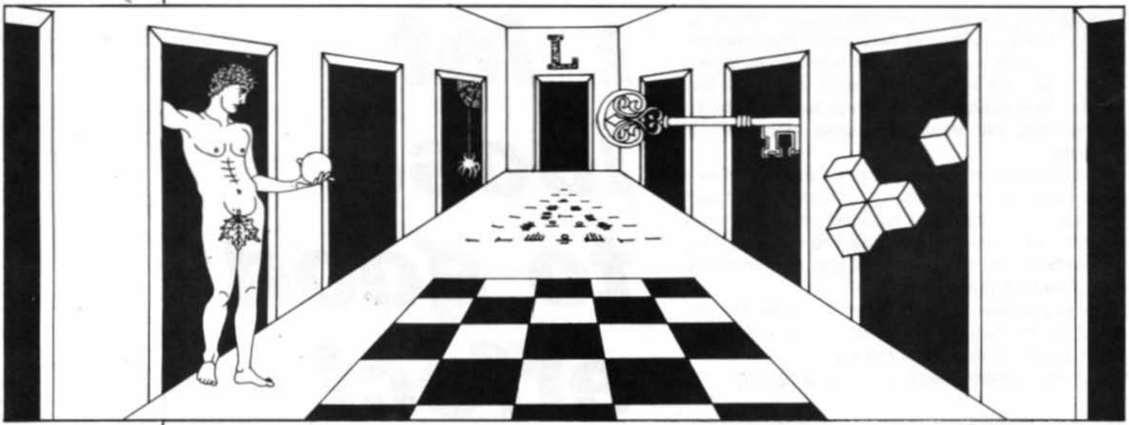
CT: They can do that as well – sometimes it will be related to a problem, sometimes an object which they find and they can have topic cards based on some of the rooms.

HT: *So you don't intend to limit the activities to just maths?*

CT: As if I would. They're already doing letter writing and there will be plenty of scope for more language work – like descriptions and story writing. I can get lots of art from them such as pictures of how the Palace might look and por-

Turn to Page 62 ►

L is available from the Association of Teachers of Mathematics, 7 Shaftsbury Street, Derby DE3 87B.



◄ From Page 61

traits of Euclid. The possibilities are endless. We can look at castles and palaces for the history angle.

HT: *How will you be able to know what stage they've reached on the program?*

CT: They'll keep their own records of where they've been, what objects they've found and what problems they've solved. Then I'll transfer all of this information on to my own master record sheets and be able to give them the appropriate worksheet.

HT: *There'll be whole-school activities which will have to take precedence – Christmas, Book Week and you'll probably have a student in your class on teaching practice at some stage.*

CT: We'll just draw those things into the topic but it's really a case of responding to them nearer the time.

HT: *This is going to be one L of a topic.*

And so it was – all the children managed to complete L and the topic finally lasted for the whole school year. The class had access to the micro for two days a week and were placed in friendship groups of three or four. There were times when the groups worked together on follow-up work while on other occasions they worked individually or as a class.

The student teacher duly arrived and, being history-oriented, was only too pleased to do work on castles. When the practice was over the class teacher followed up with some CDT activities on working models of drawbridges.

The assistance of the local comprehensive school was sought and the children made several visits to the workshops. At a later date, the children used Logo and the Cambridge Control Box to program their models via the micro. This also involved work with gears and technical Lego.

To accommodate Book Week, which involved the whole school basing its work for a week on works of literature, it was felt that as the children were working on an adventure program they could echo this by writing their own adventure game, but in book form.

The resulting book contained more than 100 locations and was eventually published and became a best-seller among other pupils in the school. The children used Wordwise Plus to produce the text and an AMX Art package with a mouse for the many illustrations.

We particularly like L for several reasons – it is almost entirely text-based with no distracting colourful pictures. This ensures that the children actually read what's written. The text itself is lucid and well-written.

It has all the fun of a commercial adventure with the content of a good educational program. It is structured so that children are encouraged to think for themselves and in all cases it is possible to leave a problem which is presenting difficulties and explore elsewhere or do work on it away from the micro.

The program is highly adaptable – it can be used purely as a stand-alone maths adventure, as a starting point for further investigative maths work or, as we used it, for a year's work across the curriculum.

Perhaps the most glowing tribute we can make is that the game held the childrens' interest for the whole school year. They learned the value of cooperation and the sharing of each other's ideas.

Their confidence in handling number work and problems was enhanced greatly, even in the least able. This was made apparent when children took standardised tests as part of the transfer to secondary school process. Perhaps this has implications for the task-orientated approach advocated by the national curriculum.

For example, the problem posed in the telephone room – and its extensions – covers several areas of the national curriculum for mathematics. In addition to the obvious links with computation, attainment targets up to level six on number patterns and up to level seven on probability were reached.

Since completing the topic, many further ideas have occurred to us. For example, a valuable and under-used activity is encouraging the children to devise their own maths problems and the program lends itself admirably to this. Anyone attempting L will doubtless think of many more.

It is a dull day and you're sitting in a staff room. The head teacher is reading the national curriculum documents, muttering dejectedly while you digest *The Micro User*. There is a feeling of apathy in the air and the future looks bleak. You turn to the Education section and read this article. You now have three choices:

- Get a copy of L and try it for yourself.
- Grab a copy of *Fractions and the Four Rules – 5000 Carefully Graded Problems.*
- Opt out.

We recommend the first course.

Dave Wales is head teacher and Denny Richardson is the teacher with overall responsibility for the curriculum at Sparrow Farm Junior School, Sparrow Farm Drive, Feltham, Middx.

As mentioned by the Mad Hatter last month, they have produced a comprehensive guide to the use of L. Copies are available from the school for £2.50, including p&p.

The truth about TELEX

How much does it cost to go on Telex?

You could go the conventional way and buy a dedicated Telex machine. The cheapest will cost you £1,604 (the Whisper), the dearest £2,892 (the Cheetah). You will also need a separate telephone line, costing £101 to install, plus £404 a year rental. That's a total outlay over the first year of a minimum of £2,109. (All prices include VAT.)

Or you could do what more and more BBC Micro users are doing – use your BBC Micro to double as a Telex machine. And just use your ordinary telephone!

How do I turn my BBC Micro into a Telex machine?

All you need is a modem and appropriate communications software (see the advertisements in this issue), a telephone, and a subscription to *MicroLink*.

Telex is just one of a growing number of services available to micro users on *MicroLink*. You can also read the news as it happens, go teleshopping, create your own closed user group, send telemessages and electronic mail right round the world, download free programs directly into your micro . . . and much more.

But why use Telex?

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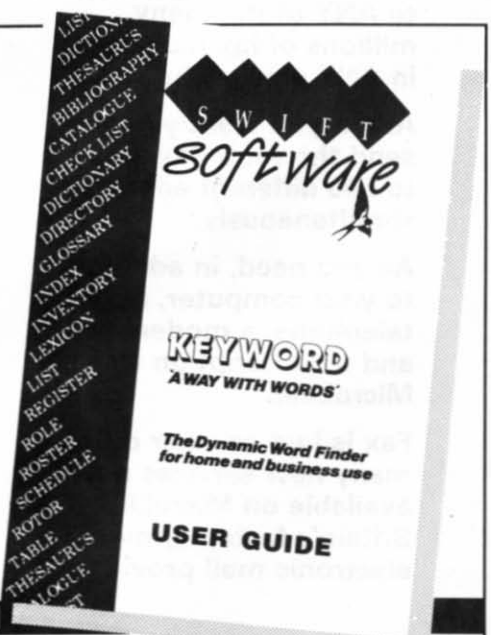

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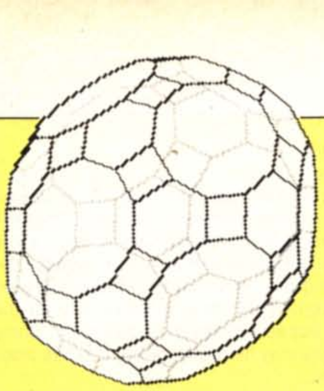
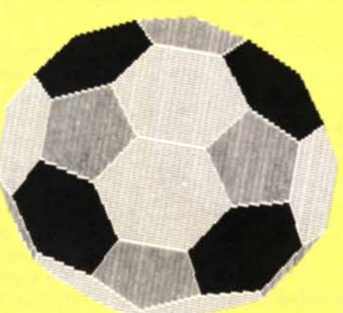




The Platonic touch

Shades of Pythagoras . . . classical shapes brought up to date by Jim Paterson

REGULAR solids with varying degrees of symmetry have fascinated people for centuries and here's a routine to draw some using your micro. A few may remind you of Elite space stations, while others are reminiscent of football patterns and geodesic domes. Many of the solids drawn by this program were known to the ancient Greeks – particularly the tetrahedron, cube, octahedron, dodecahedron and icosahedron.

All their faces are identical regular polygons and all the vertices – corners – are alike. These five are known as the Platonic solids after Plato who is known to have studied them. Their discovery however may date back to the days of Pythagoras. Euclid too made a thorough investigation of their properties in his *Elements*.

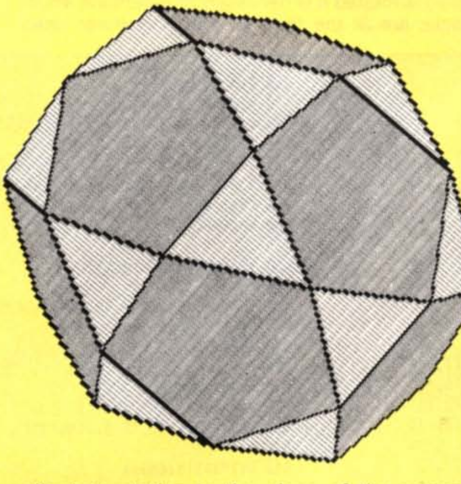
If we stick to solids with regular faces but relax the restriction that they must be identical, many others can be constructed including prisms and anti-prisms. The most visually pleasing in this category are the Archimedian solids which turn out to be related to the Platonic solids.

Five are truncated versions formed by cutting off the vertices of the platonic solids in such a way as to leave regular faces. If this truncation is carried out through the half-way points of the edges the cuboctahedron and icosidodecahedron can be made. The *rhombic* solids can then be formed by repeating this truncation on these two solids and deforming the rectangles created into squares. Two further Archimedian solids – the snub forms – exist but are not included in the program as they have different symmetries making their coordinates harder to calculate.

An important concept with many-faced solids is that of duality: The dual of a solid can be formed by replacing the faces of the original by vertices and joining them appropriately. The dual of the tetrahedron is another one, while the cube and octahedron are duals as are the dodecahedron and icosahedron. The remaining two solids drawn by the program – the rhombic forms – are the duals of the cuboctahedron and icosidodecahedron.

On running the program you are presented with a menu of the solids that can be drawn. Simply select the desired option and press Return. The vertices of the chosen solid are first plotted, then grouped into faces and the edges drawn. This may take a minute for the more complicated examples.

Once this step is completed, however, you are in control. The cursor keys can be used to rotate the solid in four directions with the < and > keys allowing rotation in the plane of the screen. Several different ways of drawing the solids are possible using the numeric keys to give the following results:



Key	**Shape display technique**
1	The default and draws only the front edges in Mode 4.
2	Like *1* but the rear edges are also drawn with dotted lines.
3	Uses Mode 5 and shows the rear edges in red.
4	In Mode 4 fills the faces.
5	In Mode 5 uses two colours for faces and one for edges.
6	Uses three colours for the faces, leaving the edges in background colour.
0	Switches black and white in any of the above forms.

Pressing Escape returns you to the main menu for a new solid to be selected.

When run the program PROCinit sets up some constants including the standard angle of rotation and the variable *phi*. This number has a history of fascination for mathematicians almost as great as the solids themselves. It is often known as the Golden Ratio and crops up often in the natural world. All the solids with five-fold ro-

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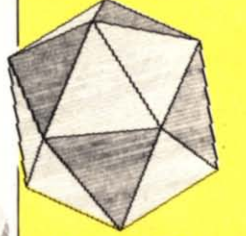

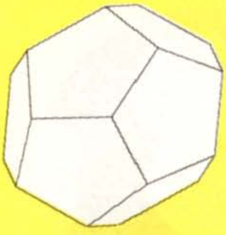

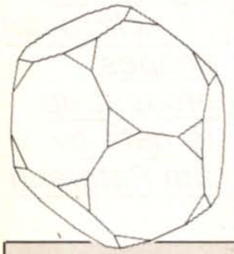

◄ From Page 65

tational symmetry use this value.

Since storing all the required coordinates would take up too much memory, only templates are stored and the various combinations of these are calculated to plot the solids in their initial positions. PROCloadv loads the vertex coordinates.

The coordinates for the face centres are then read in by PROCloadf. All the vertices are found which belong in the same plane perpendicular to the line from the origin to the face centre and these are then sorted into clockwise order in PROCsortf. The reason for this is that when the solid is rotated it is necessary to determine which faces are at the front so that only these ones need be drawn.

This will only be true for those faces whose vertices are aligned clockwise as viewed from the front and determined by FNclockwise. Notice that since all the examples are of convex solids, the faces can be drawn in any order without the possibility of overlapping. After drawing a face the surrounding edges are drawn to outline it. Some of these edges may be drawn twice, but this won't be noticeable.

All except two of the examples have the property that for each vertex or face at the front there is a corresponding opposite one at the rear. This property is used to limit the calculations necessary in rotating and plotting the solids. Not having this property, the tetrahedron and truncated tetrahedron have each face and vertex treated separately as determined by the variable *step%*.

Many enhancements may be considered for the program. New solids may be added using the same technique and if you have the available memory you could make use of modes with a greater resolution and more colours. Finally, non-convex solids could be catered for if the front faces are drawn in back to front order so that the thenearer faces cover the further ones.

```
   10 REM > Solids
   20 REM by Jim Paterson
   30 REM (c) The Micro User
   40 @%=5:*FX4,1
   50 PROCinit
   60 ON ERROR GOTO250
   70 MODE7:VDU23,1,0;0;0;0;
   80 option%=FNmenu
   90 ON ERROR GOTO240
  100 PROCview(1):MODE mode%
  110 VDU29,640;512;
  120 VDU23,1,0;0;0;0;
  130 PROCloaddata
  140 REPEAT:key%=INKEY(0)
  150 IF key%=136 PROCturnv(1,-1)
  160 IF key%=137 PROCturnv(1,1)
  170 IF key%=138 PROCturnv(0,1)
  180 IF key%=139 PROCturnv(0,-1)
  190 IF key%=44  PROCturnv(2,-1)
  200 IF key%=46  PROCturnv(2,1)
  210 IF key%=48  PROCtoggle
  220 IF key%>48 AND key%<55 PROCview(ke
y%-48):MODE mode%:VDU29,640;512;:VDU23,1
,0;0;0;0;:PROCredrawf
  230 UNTILFALSE
  240 IF ERR=17 GOTO 60
  250 MODE 7:REPORT:PRINT" at line ";ERL
  260 @%=10:*FX4
  270 END
  280 :
  290 DEF FNmenu:LOCAL opt%
  300 PRINTTAB(15,0)"SOLIDS"
  310 FOR I%=0 TO solids%
  320 PRINTTAB(0,I%+2) I%+1" "name$(I%)
  330 NEXT
  340 REPEATPRINTTAB(5,22)SPC20;
  350 INPUTTAB(5,22)"Option",opt%
  360 UNTIL opt%>=1 AND opt%<=solids%+1
  370 =opt%-1
  380 :
  390 DEFPROCinit
  400 radius=450:angle=PI/36
  410 cos=COS(angle):sin=SIN(angle)
  420 r2=SQR(2):phi=(1+SQR(5))/2
  430 DIM v(119,2)
  440 DIM angle(9)
  450 DIM face(2)
  460 DIM wkface%(9)
  470 DIM face%(31,9)
  480 DIM edges%(31)
  490 DIM vertex%(9)
  500 solids%=17:DIM name$(solids%)
  510 READ work$:I%=0:REPEAT
  520 IF RIGHT$(work$,4)="dron" OR RIGHT
$(work$,4)="Cube" name$(I%)=work$:I%=I%+1
  530 READ work$:UNTIL work$="Finish"
  540 ENDPROC
  550 :
  560 DEFPROCview(digit%)
  570 M%=digit%:T%=7
  580 IF M%=1 OR M%=2 OR M%=4 mode%=4:wh
ite%=1 ELSE mode%=5:white%=3
  590 ENDPROC
  600 :
  610 DEFPROCtoggle
  620 VDU19,0,T%;0;:T%=7-T%
  630 VDU19,white%,T%;0;:ENDPROC
  640 :
  650 DEFPROCloaddata
```

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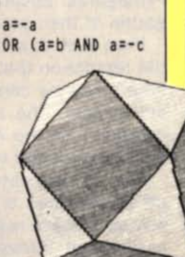
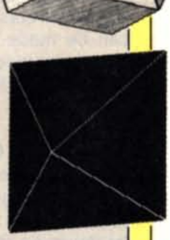
```
  660 RESTORE
  670 REPEAT:READ work$
  680 UNTIL work$=name$(option%)
  690 READ step%,vsets%,fsets%,f1%,f2%
  700 V%=-1:PROCloadv
  710 F%=-1:PROCloadf
  720 ENDPROC
  730 :
  740 DEFPROCloadv
  750 FOR sets%=1 TO vsets%
  760 READ a$,b$,c$
  770 a=EVAL(a$):b=EVAL(b$):c=EVAL(c$)
  780 IF sets%=1 scale=radius/SQR(a*a+b*
b+c*c)
  790 a=a*scale:b=b*scale:c=c*scale
  800 IF step%=2 PROCcyclicv
  810 IF step%=1 PROCparityv
  820 NEXT:ENDPROC
  830 :
  840 DEFPROCcyclicv
  850 LOCAL w,I%:I%=0
  860 REPEAT:I%=I%+1
  870 PROCaddv(a,b,c):PROCaddv(-a,-b,-c)
  880 IF a=b AND a=c GOTO 930
  890 w=a:a=b:b=c:c=w:PROCaddv(a,b,c)
  900 PROCaddv(-a,-b,-c)
  910 w=a:a=b:b=c:c=w:PROCaddv(a,b,c)
  920 PROCaddv(-a,-b,-c)
  930 IF I%=3 c=-c ELSE a=-a
  940 UNTIL c=0 OR I%=4 OR (a=b AND a=-c
)
  950 ENDPROC
  960 :
  970 DEFPROCparityv
  980 PROCaddv(a,b,c)
  990 PROCaddv(-a,-b,c)
 1000 PROCaddv(a,-b,-c)
 1010 PROCaddv(-a,b,-c)
 1020 ENDPROC
 1030 :
 1040 DEFPROCaddv(aa,bb,cc)
 1050 V%=V%+1:PLOT69,aa,bb
 1060 v(V%,0)=aa:v(V%,1)=bb
 1070 v(V%,2)=cc:ENDPROC
 1080 :
 1090 DEFPROCloadf
 1100 F1%=255:F2%=255
 1110 FOR sets%=1 TO fsets%
 1120 IF sets%=f1% F1%=F%
 1130 IF sets%=f2% F2%=F%
 1140 READ a$,b$,c$
 1150 a=EVAL(a$)*scale
 1160 b=EVAL(b$)*scale
 1170 c=EVAL(c$)*scale
 1180 dist2=a*a+b*b+c*c
 1190 IF step%=2 PROCcyclicf
 1200 IF step%=1 PROCparityf
 1210 NEXT:ENDPROC
 1220 :
 1230 DEFPROCcyclicf
 1240 LOCAL w,I%:I%=0
 1250 REPEAT:I%=I%+1
 1260 PROCaddf(a,b,c)
 1270 IF a=b AND a=c GOTO 1300
 1280 w=a:a=b:b=c:c=w:PROCaddf(a,b,c)
 1290 w=a:a=b:b=c:c=w:PROCaddf(a,b,c)
 1300 IF I%=3 c=-c ELSE a=-a
 1310 UNTIL c=0 OR I%=4 OR (a=b AND a=-c
)
```





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Through the re-sizable window

After the special forms, Ken Down's Wimps series moves to general windows

EVER since this series started we have been using windows. Both menus and dialogue boxes are specialised forms of window, however most people think of windows as brightly coloured rectangles complete with scroll bars that can be moved and re-sized. Now, at long last, we are going to construct a *real window.*

First, though, we have unfinished business from last month, when if you clicked the OK button before filling out all the details in the input dialogue box a warning message was displayed. But clicking Continue did nothing. We need to add a couple of extra lines to the clickwindow procedure:

```
2670 IFalert%=handle%j%=FNclickdialogalert(ic
on%)
2780 ENDPROC
```

If the window handle returned by FNpoll is the same as the handle of the alert box we call FNclickdialogalert, informing it which mouse button was clicked and which icon the arrow was pointing to.

FNclickdialogalert starts off by checking that the arrow is pointing to one of the icons. If you click inside the window – but not over an icon – the value of *icon%* is –1 and we simply end the procedure.

As there is only one icon in the alert box there is no need to check further, so we invert its colour and close the window. The final line of the procedure resets the mouse rectangle to its old limits, whatever they were, and sets *alert%* to FALSE:

```
3100 DEFFNclickdialogalert(icon%):IFicon%<0 =
FALSE
3110 PROCinverticon(alert%,icon%):PROCclosewi
ndow(alert%)
3120 PROCmouselimit(oldmbx%,oldmby%,oldmtx%,o
ldmty%):alert%=FALSE:=TRUE
```

Leaving the window until last, we now turn to the load and save routines. Start by adding the following three lines to the menu select routine:

```
1670 WHEN5:PROCbalance
1680 WHEN6:PROCload
1690 WHEN7:PROCsave
```

The Archimedes uses the same file commands as the rest of the Acorn range, so there is nothing surprising in the file procedures. Notice, however, that the filename is taken from the *filename%* block. This contains a default string, but can have a different name entered by the user.

Let's insert a meaningful default value:

```
2650 IFbutton%=2$filename%="AcountFile":$mtex
t%="CAT":SYS"Wimp_CreateMenu",0,menublock%,mo
usex%,mousey%
```

Notice how PROCcreatealert is used to check that there is a valid filename and to warn the user if there isn't. This same technique can be used in many ways, for example when loading you can check that the required file is present on the disc.

There is another, fairly arcane, possibility. Using *SETTYPE you can give your files a distinctive number. While you can use any value between &000 and &FFF for your private programs, the numbers from &E00 to &FFF are reserved for Acorn and &800 to &DFF are for software houses. If you are producing a program for release to the public you should write to Acorn for an exclusive value.

The file type number can be read with the command SYS"OS_File" with R0 set to 5 and several other registers set to various values. This call is documented on page 235 of the Programmer's Reference Manual. In this way you can

> *'The Archimedes uses the same file commands as the rest of the Acorn range'*

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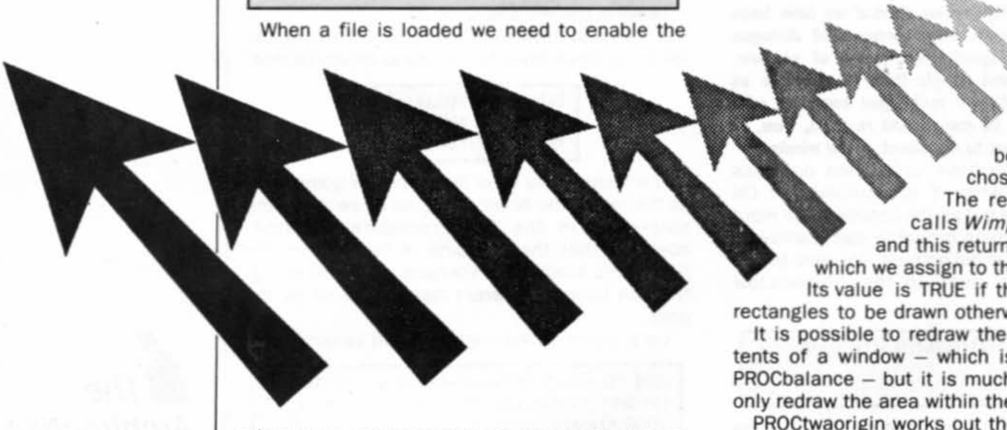
ensure that your program will only load its own type of files.

```
11000 DEFPROCsave:IF$filename%=""PROCcreateal
ert("Invalid filename!"):ENDPROC
11010 F%=OPENOUT(":0.$."+$filename%):PRINT#F%
,N%,L%
11020 FORI%=0TON%:PRINT#F%,ac$(I%):NEXT
11030 FORI%=0TOL%:PRINT#F%,r$(I%):NEXT:CLOSE#
F%:ENDPROC
```

The variables *N%* and *L%* hold the number of accounts and the number of entries respectively.

```
10900 DEFPROCload:IF$filename%=""PROCcreateal
ert("Invalid filename!"):ENDPROC
10910 F%=OPENIN(":0.$."+$filename%):INPUT#F%,
N%,L%
10920 FORI%=0TON%:INPUT#F%,ac$(I%):NEXT
10930 FORI%=0TOL%:INPUT#F%,r$(I%):NEXT:CLOSE#
F%
10940 FORi%=1TOLENmenu$:IFMID$(menu$,i%,1)="*
"MID$(menu$,i%,1)="."
10950 NEXT:g%=INSTR(menu$,".Load"):MID$(menu$
,g%,1)="*"
10960 j%=FNcreatemenu(menublock%,menu$,textbl
ock%):ENDPROC
```

When a file is loaded we need to enable the other menu options and at the same time disable the load option. This is to prevent the user from loading in an old file on top of a whole lot of new entries.



If you want to display a balance sheet – the total of all entries to date – click option 6 on the main menu. Line 1670 calls PROCbalance when this option is selected. This procedure creates a window – moveable with a title bar and scroll bars – with a flag of &F. You can use the utility procedure PROCdecodewindow to check the meaning of this flag.

```
11100 DEFPROCbalance:bal%=FNcreatewindow("Bal
ance",&F,0,7,1224,L%*32,0,0,1280,1024,0)
11110 PROCopenwindow(bal%,block%)
11120 w%=FNwhich(bal%):window%(w%,0)=&FF:ENDP
ROC
```

I'll explain the purpose of line 11120 in a later article. Having opened the window, we do nothing further about it, in fact it doesn't even appear on the screen. This is because opening a window is not the same as drawing it. Instead the *Wimp–CreateWindow* call returns a code that tells the Wimp Manager to re-draw the window and we recognise this call with line 230.

```
230 WHEN1:PROCredrawwindow(!poll%)
```

PROCredrawwindow is an interesting procedure. I was disappointed to find that the contents of a window are not automatically preserved by the Wimp. Probably I had inflated and unrealistic expectations, but I really thought that once you defined a window its contents were preserved in some part of memory.

In fact it is up to your program to re-draw the window. In the case of the first screen of our balance sheet the whole window has to be produced, so there is no problem.

Imagine, however, a window which has been overlapped by two others. You decide to bring that to the front by means of the little icon at top left of the window. Because all windows are rectangular the areas that will have to be redrawn can be described as a series of rectangles.

The Wimp tells you about these rectangles as a result of the call *Wimp_GetRectangle*. In fact, this sets up a graphics window – the VDU24 kind – on the screen so that all printing and drawing will only be visible within the chosen area.

The re-draw procedure calls *Wimp_ RedrawWindow* and this returns a flag in R0 and which we assign to the variable *more%*. Its value is TRUE if there are any more rectangles to be drawn otherwise its FALSE.

It is possible to redraw the whole of the contents of a window – which is what is done by PROCbalance – but it is much more efficient to only redraw the area within the graphics window.

PROCtwaorigin works out the scrolled position of the window. *Wimp_RedrawWindow* puts the scroll bar position in block%!20 (x-scroll bar) and block%!24 (y-scroll bar). This position is returned to the variables *x0%* and *y0%*.

```
3300DEFPROCtwaorigin(b%,RETURN x%,RETURN y%)
3310x%=b%!4-b%!20:y%=b%!16-b%!24:ENDPROC
```

Programmers have long lamented the fact that a function – can only return a single value. At last those nice people at Acorn have provided the answer. By using the keyword RETURN in the procedure definition you can have as many values as you like returned to the calling statement.

Notice the space between RETURN and the variable name. Unlike most of BBC Basic, these spaces are important and must be present otherwise the RETURN function won't work – a quirk that the handbooks don't mention.

FNwhich returns a value in the range 0 to 31

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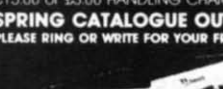
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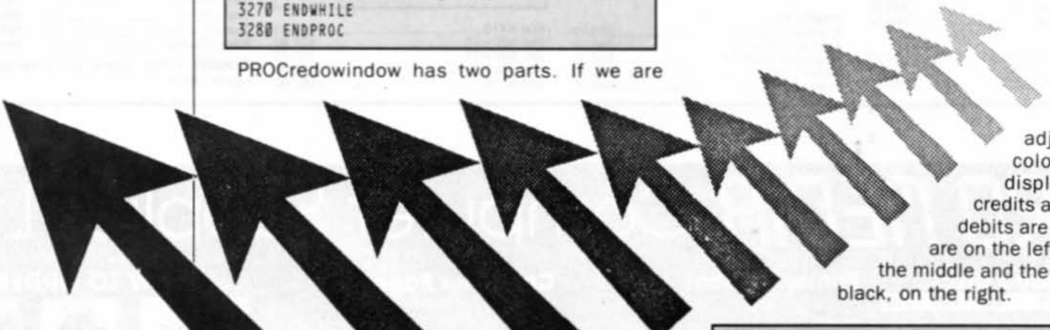
that indicates which window is being considered:

```
11500DEFFNwhich(j%)=(j%-960)DIV8
```

The PROCredrawwindow then enters a WHILE..ENDWHILE loop and invokes PROCredowindow which does the actual work of redrawing the window. *Wimp_GetRectangle* is then called to find out if there are any more rectangles to be drawn:

```
3200 DEFPROCredrawwindow(handle%):LOCALmore%,
x0%,y0%
3210 !block%=handle%:SYS"Wimp_RedrawWindow",0
,block%TOmore%
3220 PROCtwaorigin(block%,x0%,y0%):w%=FNwhich
(handle%)
3230 WHILEmore%
3240 block%!28-=x0%:block%!32-=y0%:block%!36-
=x0%:block%!40-=y0%
3250 PROCredowindow(x0%,y0%,window%(w%,0),win
dow%(w%,1))
3260 SYS"Wimp_GetRectangle",0,block%TOmore%
3270 ENDWHILE
3280 ENDPROC
```

PROCredowindow has two parts. If we are asking for the total balance – which is what we want this month – all the accounts are listed on screen using PROCsplit and PROCshow. If we are listing a single account we have to check whether the record details are the same as the area and account numbers before printing it on the screen:



```
11200 DEFPROCredowindow(x0%,y0%,ar%,nme%):bala
nce=0:PROCtwaorigin(block%,x0%,y0%)
11210 IFar%=&FFr%=L%*32-4:FORi%=0TOL%-1:PROCsp
lit(i%):PROCshow(r%+y0%):r%-=32:NEXT:ENDPROC
11220 r%=window%(w%,2):FORi%=0TOL%-1:PROCsplit
(i%):IFar%=ac%IFnme%=nm%PROCshow(r%+yfl%):r%-
=32
11230 NEXT:ENDPROC
```

Because the balance has to be calculated all the way through it is not possible to re-draw just part of the window. Scrolling becomes rather slow and tedious as soon as you get any significant number of entries. It is not helped by the fact that printing to the screen is done in VDU5 mode which is slower than VDU4.

In fact, as more than one rectangle may be involved in the re-drawing of the screen, the whole calculation may have to be gone through several times for each re-drawing of the window. You can see this in action if you type in a windowful of entries and then call up the balance sheet. Click Menu and run the pointer over the Delete option so that you have three menu boxes on the screen.

Scrolling becomes rather slow and tedious as soon as you get any significant number of entries

Now click a button outside the menu boxes so that they disappear and observe how the former position of each menu box is filled in separately. The effect is even more interesting if you – temporarily – stick a CLS on the end of line 280.

PROCsplit divides a particular element of the array *r$()* into its component parts: *ac%* is the area number, *nm%* the account number, *cr%* signals whether the entry is credit or debit and *val* is the amount – *date$* and *detail$* are fairly self-explanatory:

```
11300 DEFPROCsplit(i%):date$="":$R%=r$(i%)
11310 ac%=?R%:nm%=R%?1:cr%=R%?2:val=|(R%+3)
11320 FORi%=8TO18:date$+=CHR$i%?R%:NEXT
11330 detail$=$(R%+19):sgn%=(1-2*cr%):ENDPROC
```

PROCshow displays the data on the screen, adjusting the colours of the display so that credits are blue and debits are red. Debits are on the left, credits in the middle and the balance, in black, on the right.

```
11400 DEFPROCshow(v%):GCOL0:MOVE10+x0%,v%:PRIN
Tdate$
11410 MOVE230+x0%,v%:PRINTdetail$
11420 GCOL(cr%*3)+1:MOVE(46+10*cr%)*16+x0%,v%:
PRINTval
11430 balance+=(val*sgn%):GCOL0:MOVE66*16+x0%,
v%:PRINTbalance:ENDPROC
```

Having got your window on the screen you now want to get rid of it. This is accomplished by clicking on the cross at top left of the screen, which should call PROCclosewindow. Try it and nothing happens. That is because the Wimp–Poll routine returns a result of three, which we have to acknowledge in PROCaction.

```
250 WHEN3:PROCclosewindow(!poll%)
```

We need to keep track of the fact that the balance window is open, which we do by setting the flag *bal%* to the value of the window handle. When we close the window, however, we need to reset the flag to zero. As we will need to do the same for a couple of other flags, our final line is:

```
1120 IFbal%=handle%bal%=0ELSEIFalert%=handle%
alert%=0ELSEIFdel%=handle%del%=0
```

● *Next month we'll look at the crucial edit and listing options and examine how to resize a window.*

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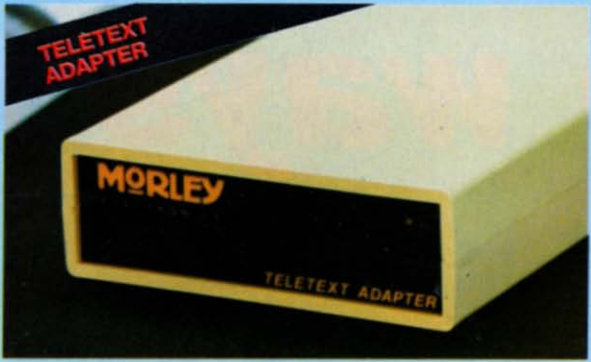

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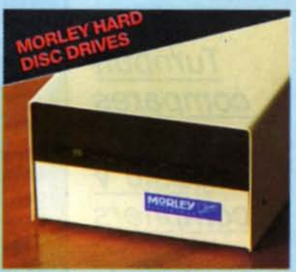

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Two ways t

BBC Basic V must be the fastest interpreted version of the language on any micro in the world – after all, 8 bit BBC Basic is faster than most 16 bit machines – and as such it might seem strange to want it to be even speedier. But Dabs Press and Silicon Vision have produced compilers that change Basic into ARM code to do just that.

ABC
COMPILER

Steve Turnbull compares a couple of Basic V compilers

Product: Archimedes Basic Compiler (version 2)
Price: £99.95
Supplier: Dabs Press, 5 Victoria Lane, Whitefield, Manchester M25 6AL.
Tel: 061-766 8423

ABC is provided with two manuals – a user guide and reference manual – two discs and a version 2 update. The user guide covers general aspects of the compiler – using directories, common compiler directives, error messages and general hints.

The reference manual goes into more detail for experienced users and explains every Basic command stating how the compiler differs in its handling, if it does at all. In fact it's largely a waste, giving much the same information as is contained in the documentation provided with the machine itself.

Version 2, which is Risc OS compatible, loads itself on to the icon bar then adds the compilation and ABCLib modules – 228k and 14k respectively – to the RMA. It is after doing this that it checks to see if there is enough space to load the front end. Why not check before loading?

The compiler options available from the command line are quite limited – you can only produce a listing, compile in ram or set up to auto-run the code after it's been generated. Anything else has to be inserted as directives within REM statements.

The fact that the compiler is held as a module is very useful as it means it's always on line and ready to go but on a 1Mb machine you begin to run short of other multi-tasking software you can have loaded.

ABC treats machine code unusually, assembling the code at run time instead of making it part of the compiled code. However, you are recommended to pre-assemble externally and load the routines during initialisation – certainly a sound suggestion. Unlike the interpreter the compiler will accept floating point instructions.

Control over the type of variables can be controlled easily. The Basic interpreter only allows real numbers, integers and strings with the last two having % and $ suffixes. The ABC allows three levels of floating point precision – single, double and extended – plus integer and string, and you can also define what suffixes should be used to recognise them.

The most serious omission is that ABC cannot handle even the most simple matrix operations. One of the most important features of BBC Basic V is its ability to perform the basic matrix calculations – addition, subtraction, multiplication and dot product – and without this facility ABC cannot be taken as a serious contender in this field.

Product: RiscBasic
Price: £99.95
Supplier: Silicon Vision Ltd, Signal House, Lyon Road, Harrow, Middlesex HA1 2AG.
Tel: 01-422 2274

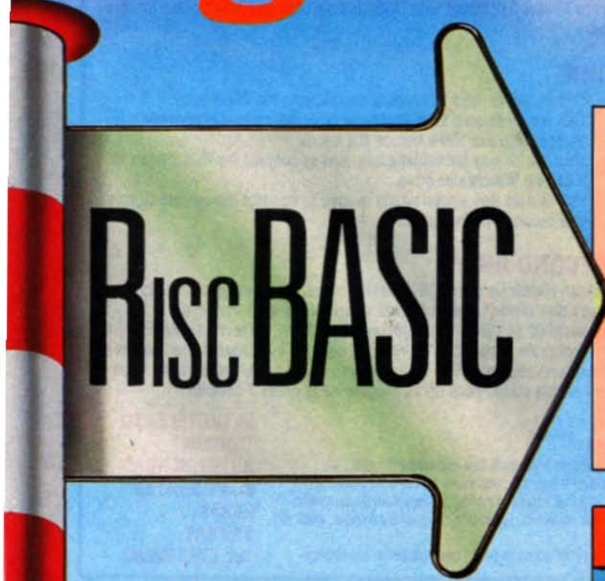
THE RiscBasic package comes on a single disc with a 32 page manual – of which only 19 are actually dedicated to the compiler itself. The reason given for this is that, since it copes with virtually everything in Basic V, there's very little you need to know beyond a few special situations. The version supplied operated in both Arthur 1.2 and Risc OS, but a dedicated multitasking one which will compile all 1.04 amendments to Basic V will be ready as you read this.

Like ABC, RiscBasic has most problems with machine code but deals with it in a much more satisfactory manner. The code is assembled at compile time, but this generates its own problems: Variables, which have values set when the program is run, cannot be used in the assembler. This means that, for example, if you use *sp* to represent register 13 – the stack pointer – an error is produced.

You can get around this by declaring constant values, while a variable can be accessed by instructing the compiler to load its memory address which can then be examined.

The RiscBasic compiler will also cope with

o go faster



floating point instructions and, like ABC, you are recommended to pre-assemble any machine code to be loaded at run time.

If you know that your program uses no real numbers – or they're not actually needed – you can use a directive to force the use of integers only, which will certainly speed up execution. As with ABC, floating point calculations through the emulator are slow, although the addition of the required chip would make such programs lightning fast.

The main problem with RiscBasic is the file structure that is enforced on you. In its default state you must use directory B to hold the Basic source program, O for the object code and L contains some scratch and utility files. All these must be present in the current directory – usually $. For dedicated users this is a serious and quite unnecessary limitation.

Silicon Vision did point out that filenames in the command line used to invoke compilation can be preceded by * to force proper use of path names, and their multi-tasking interface does allow you to use this facility quite transparently. However, it's not fully documented.

The number of compiler command line options is quite extensive, covering both file output – you can store errors and cross-reference listings separately – and variations such as whether to check for maths overflow, produce faster code for single exit loops and so on.

Within the program you can also issue a vast number of compiler directives – within REMs – which allow you to perform conditional compilation and set constants. If you are creating a module you can set up help and syntax strings, pass the parameters in the command line *tail* to string variables within the program, also you can implement other system commands and assign their execution to particular procedures.

The jury returns

On the whole RiscBasic produced faster code than ABC except on real maths type calculations, where ABC was slightly better. The one area where ABC scores over RiscBasic is in the use of its library module which results in very much tighter code – and probably causes the slower speed.

The dedicated compiler directives to support software modules in RiscBasic make it very useful indeed for development work. The ABC support for modules is satisfactory, but much less flexible.

However, the inability of ABC to handle matrix operations is a very serious limitation and this fact alone would make RiscBasic the overall winner even if it hadn't produced significantly more efficient code. RiscBasic compiles all Basic V operations. ABC doesn't.

Compiler comparisons

RiscBASIC v1.2 Benchmarks

Program	Interpreter	RiscBasic	ABC
Ackerman	4.53	0.18	0.16
Fibonacci	9.49	0.17	0.55
For..Next (10000)	23.41	1.55	3.58
Graphics to Screen	1.66	0.80	0.84
Integer Array	1.67	0.08	0.49
Integer Maths	2.04	0.28	0.28
Real Array	1.78	0.87	1.91 *
Real Maths	0.29	0.41 *	0.32 *
Repeat..Until (10000)	12.87	0.11	0.39
Savage	4.27	9.05 *	9.29
Sieve (1651 primes)	6.03	0.12	0.25
String Array (10000)	1.15	0.02	--
Text to Screen	2.51	2.24	2.32
Trigs & Logs	1.37	4.06 *	4.04 *
While loop (10000)	10.04	0.14	0.36

ABC Benchmarks

Program	Interpreter	RiscBasic	ABC
Ackerman	5.29	0.05	0.22
Graphics to Screen	1.66	0.91	0.84
Integer maths	0.21	0.02	0.02
Real Maths	0.29	0.41 *	0.33 *
Sieve	5.36	0.35	0.86
Store	2.80	2.90 *	2.76
Text to screen	2.51	2.26	2.31
Trigs & Logs	1.39	4.07 *	4.04 *

** Slower than the Basic Interpreter*

Both packages supply demonstration programs and benchmarks – however you can always write programs to show compilers in their best light. So we ran each demo supplied through both compilers to avoid this problem.

The programs were only run once, but speeds differed very little from run to run where tested. In addition all tests were done in Mode 12 which, apart from being the most common one used, meant the results are slower than those published by the individual companies themselves because their tests were done in Mode 0. Higher resolution screen modes result in slightly slower programs.

Speed comparisons between ABC and RiscBasic

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Fun with fractals

Mike Cook begins a short series on creating mathematical monsters

FRACTALS are a topic of increasing interest to us in the computing fraternity. In fact the mathematical foundations have been around since the turn of the century, but it is only with the advent of low cost computing power that the full potential of fractals is being realised. In this series we'll look at some experiments with them that you can perform on your micro.

First, what exactly is a fractal? The term was coined by one of the famous names in this branch of mathematics, Benoit B. Mandelbrot, and it stands for the state of a line or surface with a fractional dimension.

This may take some thinking about, so let's illustrate it with one of the earliest fractals – the von Koch snowflake curve.

This was first described in about 1904 – long before the word fractal had been coined. For years this curve and similar ones were considered as mathematical monsters.

In Euclidian geometry – the type you learnt at school – a curve is described by a mathematical formula. For example all points on a circle can be found from:

```
R=SQR(X*X+Y*Y)
```

where X and Y are the coordinates of the point and R is a constant – the radius. This equation describes all about the circle no matter what scale you look at it. In contrast, the von Koch snowflake curve is described, not by a formula, but by a procedure – a set of rules – or as we say in computer jargon, an algorithm, and this allows you to draw the curve.

For the von Koch snowflake curve the rule is simple:

Take a line – this is called the axiom – and divide it into three parts. Substitute for the middle part two sides of a triangle and the curve will now be composed of four straight line sections. Next take each straight line section and apply the same rule. Repeat infinitely.

Now as we have an infinite number of repeated rules, the bends and twists will soon be less than the pencil line we are using, so there is no need to apply any more substitutions. We have drawn an approximation to the curve, the order of the approximation being given by the number of times we have applied the substitution rule.

If we look at a highly magnified section of this curve it will look the same as an unmagnified section. In fact no matter how much we magnify the curve it always looks the same. Contrast this with a circle. If we magnify a section of that it appears as an arc. As we look closer the arc straightens to become a straight line so that under infinite magnification a circle looks like a straight line. We say a circle has a fractal dimension of one.

If a curve looked like a solid area under magnification we would say it was a surface and so it would have a fractal dimension of 2. A von Koch snowflake curve has a dimension somewhere in between these, in fact it is about 1.26. This is a irrational number like PI and there is no need to worry about how it is calculated here. The fractal dimension is a measure of the wiggliness of the line, different fractal curves having different dimensions.

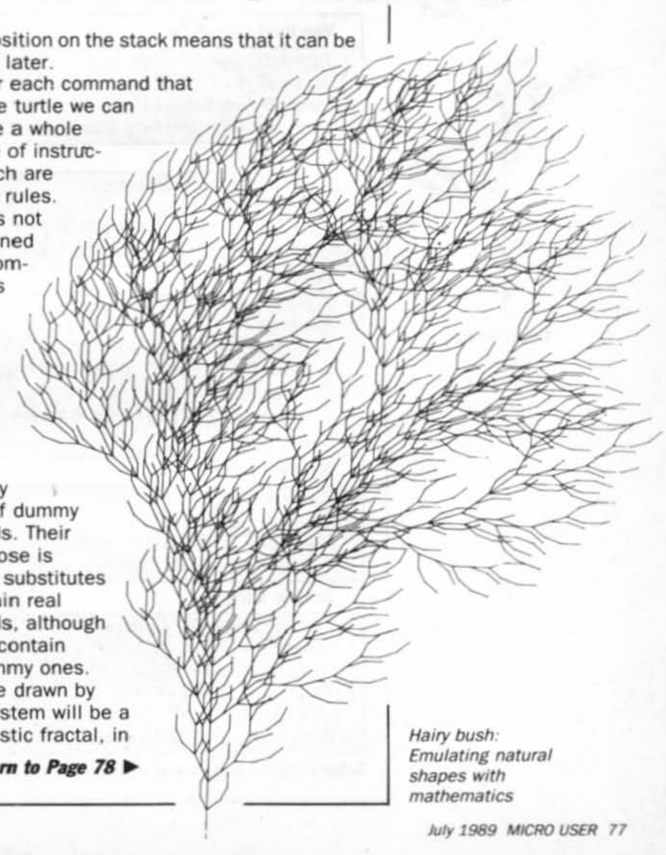
Fractal curves offer us a simple way of drawing complex and beautiful shapes with our micros. The repetitive nature of the application of rules makes it ideal for computers.

You could write a program that will perform the rules for a single curve, but you would need a different program to draw each different one. What we need is some way of inputting the rules simply from the keyboard and letting the micro get on with it.

To this end a method has been developed called the OL System which encompasses a number of drawing commands. These work very much like the turtle commands in Logo. You can think of it as a pointer or turtle and tell it to move forward, turn left or right, or draw a line. The proper name for such a system is a body-centered co-ordinate system. Table I shows the commands: Note that the angle through which the turtle turns is fixed for any one curve. Saving the current position on the stack means that it can be recovered later.

Now for each command that moves the turtle we can substitute a whole sequence of instructions which are known as rules. If one has not been defined for any command it is simply replaced by itself, and in order to make life simpler we can define any number of dummy commands. Their only purpose is that their substitutes can contain real commands, although they can contain other dummy ones. Any shape drawn by such a system will be a deterministic fractal, in

Turn to Page 78 ▶

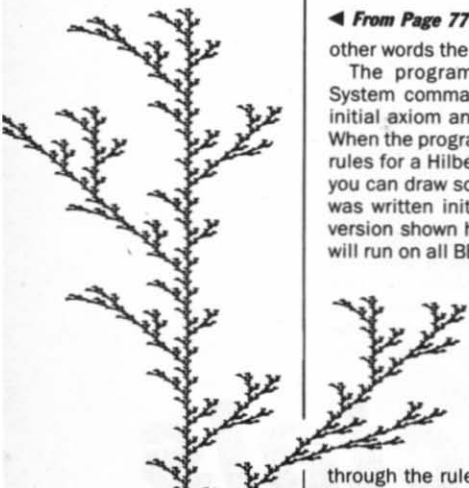


Hairy bush: Emulating natural shapes with mathematics

F	Move one step forward and draw a line
f	Move one step forward and do not draw a line
+	Turn to the right through a fixed angle
–	Turn to the left through a fixed angle
|	Turn back (180 degrees)
[	Save position of turtle on a stack
]	Recover the state of the turtle from the stack

Table I: 0L System commands

◄ *From Page 77*



Water weed

other words the shape is determined by the rules.

The program given implements all the 0L System commands and allows you to enter the initial axiom and any number of transition rules. When the program is first run you will find that the rules for a Hilbert curve have been preset so that you can draw something right away. The program was written initially on the Archimedes, but the version shown here has been modified so that it will run on all BBC Micros. Naturally, it runs much slower on the 8 bit machines but still a number of very interesting curves can be produced.

Basically, rules are entered from the keyboard and are held in a string variable. When the program starts to draw the curve it will first examine each letter of the axiom. Then it will search through the rules to find out what string of commands to substitute for the first.

This string will be examined one command at a time and again the rules searched for the substitutions to be made. This repeats until the number of substitutions made is the same as the order of the curve being drawn and it then obeys the command. This sort of procedure is ideally suited to a recursive implementation and this is what the program uses.

The heart of the program is the procedure PROC–CURVE – lines 330 to 510 – which is called recursively. Originally there were two FOR...NEXT loops in this procedure with *E%* and *B%* as the loop variables.

This worked fine on the Archimedes, however when it was transferred to the BBC Micro the error message *Too many FORs* was encountered on high order curves. This illustrates the different ways the two machines handle nested FOR...NEXT loops. On 8 bit machines it is done with a fixed amount of store, whereas on the Archimedes it is done using a relocatable, resizeable amount of memory.

Lines 530 to 640 implement the basic commands and lines 650 to 720 convert between the body centered coordinate system and the screen system. The program does not know initially how big the curve is going to be, as this is determined by the length of line used in the drawing – the form of the rules and order of the curve. After each curve has been drawn scaling factors are adjusted to get the curve to fill the whole screen. Because of this, some drawing may initially take place off the screen. For most curves the program manages to fill the screen on the third attempt.

When the curve has been drawn the micro will beep to indicate it has finished. The finished

Von Koch Snowflake	*Turning angle 60 Degrees,* *Axiom F* *Rule for F is F–F++F–F* This is an infinitely long line in a finite space.
Koch Island	*Turning angle 60 Degrees,* *Axiom F+F+F+F* *Rule for F is F+F–F–FFF+F+F–F* This is a closed version of the Snowflake.
Peano Curve	*Turning angle 90 Degrees* *Axiom X* *Rule for X is XFYFX+F+YFXFY-FXFYFX* *Rule for Y is YFXFY–F–XFYFX+F+YFXFY* *Rule for F is F* This is a space filling curve, a single line fills a bound space.
Sierpinsky Curve	*Turning angle 90 Degrees* *Axiom F+F+F+F* *Rule for F is FF+F+F+F+FF* This is a recursive square.
Dragon Curve	*Turning angle 90 Degrees* *Axiom X* *Rule for X is X+YF* *Rule for Y is –FX–Y* *Rule for F is F* Space filling and infinite perimeter.
Sierpinsky Gasket	*Turning angle 60 Degrees* *Axiom FXF––FF––FF* *Rule for F is FXF* *Rule for X is ––FXF++FXF++FXF––* Recursive triangles, we shall meet this one again later in the series.
Water Weed	*Turning angle 26 Degrees* *Axiom F* *Rule for F is F[+]FF[–F]F*
Another Weed	*Turning angle 26 Degrees* *Axiom G* *Rule for G is GFX[+G][–G]* *Rule for X is X[–FFF][+FFF]FX* *Rule for F is F*
Bush	*Turning angle 22.5 Degrees* *Axiom F* *Rule for F is FF+[+F–F–F]–[F+F+F]*
Hairy Bush	*Turning angle 18 Degrees* *Axiom SLFFF* *Rule for S is [+++G][–––G]TS* *Rule for G is +H[–G]L* *Rule for H is –G[+H]L* *Rule for T is TL* *Rule for L is [–FFF][+FFF]F* *Rule for F is F*

Table II: Some curves and their rules

curve will be displayed until a key is pressed and you will see the parameters you have at present and be invited to change some.

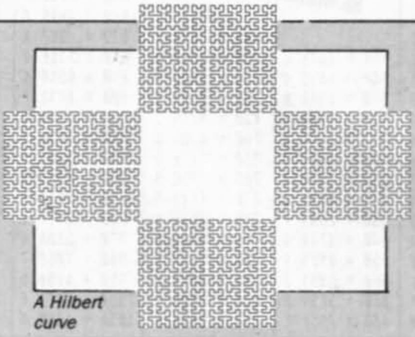
Any key pressed here apart from Y results in the curve being re-drawn. You can abandon any curve by holding down the spacebar. Note, however, when you do this that the scaling factors will not be complete. This escape is useful when you have changed your mind about some curve parameter. When the curve order is changed the line length is set short to try and ensure that most of it will fit on the screen first time.

Now let's see what other curves the program can produce. Take the initial conditions and change the axiom to X+X+X+X. This will draw four connected Hilbert curves forming a bound area. You can experiment with other rules. Table II shows some classic fractal curves. Note that they do not all have to be geometrical – some are quite good representations of bushes and water weeds.

When experimenting with your own shapes the best approach is to take one of the sets of rules in the table and modify some aspect of rules or axiom. You never know, you might come up with a previously unknown curve let us know and we'll publish the best.

● *Next month I will look at another aspect of fractal generation. Until then, have fun.*

```
   10 REM Generalised fractal generator
   20 REM By Mike Cook
   30 MODE0
   40 DIM R$(1,30),ST(2,40)
   50 SX=0:SY=0
   60 SFx=32/1280
   70 SFy=32/1024
   80 SP%=0 : REM STACK POINTER
   90 FA=PI/2 : REM FIXED ANGLE (RADS)
  100 VA=-PI-PI/2 : REM VECTOR ANGLE (RA
DS)
  110 RD%=3 : REM RECURSION DEPTH
  120 AX$="X"
  130 R$(0,1)="F"
  140 R$(1,1)="F"
  150 R$(0,2)="X"
  160 R$(1,2)="-YF+XFX+FY-"
  170 R$(0,3)="Y"
  180 R$(1,3)="+XF-YFY-FX+"
  190 MX%=3
  200 PROC_INTRO
  210 REPEAT
  220 PROC_DISP
  230 V=VA:X=SX:Y=SY
  240 MaxX=X:MaxY=Y
  250 MinX=X:MinY=Y
  260 MOVE X,Y
  270 FIRST%=TRUE
  280 PROC_CURVE(AX$,1)
  290 VDU 7:A$=GET$
  300 PROC_SF
  310 UNTIL FALSE
  320 :
  330 DEF PROC_CURVE(AX$,RL%)
  340 IF INKEY(-99) ENDPROC
  350 LOCAL A%,B%,C$,D$,E%
  360 A%=1
  370  C$=MID$(AX$,A%,1)
  380  REM LOOK FOR A RULE
  390  E%=0
  400  REPEAT
  410   E%=E%+1
  420   UNTIL R$(0,E%)=C$ OR E%>MX%
  430   IF NOT(NOT(E%>MX%) AND RD%<>RL%)
PROC_TURTLE(C$) : GOTO 490
  440   B%=1
  450    D$=MID$(R$(1,E%),B%,1)
  460    PROC_CURVE(D$,RL%+1)
  470  B%=B%+1
  480 IF B% < (LFN(R$(1,E%))+1) THEN 450
  490 A%=A%+1
  500 IF A% < (LEN(AX$)+1) THEN 370
  510 ENDPROC
  520 DEF FN_TURN(V)
  530 IF V<PI V=V+PI ELSE V=V-PI
  540 =V
  550 DEF PROC_TURTLE(C$)
  560 IF C$="F" PROC_CO_ORDS:PLOT 5,X,Y
  570 IF C$="+" V=V+FA
  580 IF C$="-" V=V-FA
```



A Hilbert curve

```
  590 IF C$="f" PROC_CO_ORDS:PLOT 4,X,Y
  600 IF C$="|" V=FN_TURN(V)
  610 IF C$="[" SP%=SP%+1:ST(0,SP%)=X:ST
(1,SP%)=Y:ST(2,SP%)=V
  620 IF C$="]" X=ST(0,SP%):Y=ST(1,SP%):
V=ST(2,SP%):SP%=SP%-1:MOVE X,Y
  630 ENDPROC
  640 :
  650 DEF PROC_CO_ORDS
  660 X=X+SIN(V)/SFx
  670 Y=Y+COS(V)/SFy
  680 IF X>MaxX MaxX=X
  690 IF X<MinX MinX=X
  700 IF Y>MaxY MaxY=Y
  710 IF Y<MinY MinY=Y
```

This is one of hundreds of programs now available FREE for downloading on MicroLink

```
  720 ENDPROC
  730 :
  740 DEF PROC_DISP
  750 CLS
  760 PRINT"Fractal Curve Generator"
  770 PRINT"By Mike Cook"
  780 PRINT
  790 PRINT"Current parameters are:-"
  800 PRINT"1) Start angle ";DEG(VA);" D
egrees"
  810 PRINT"2) Turning angle ";DEG(FA);"
 Degrees"
  820 PRINT"3) Curve order ";RD%
  830 PRINT
  840 PRINT"4) Axiom is ";AX$
  850 PRINT
  860 IF MX%=0 THEN 920
  870 FOR A%=1 TO MX% ·
  880 PRINT;A%+4;") Rule ";R$(0,A%);
  890 PRINT" to> ";R$(1,A%)
  900 PRINT
  910 NEXT
  920 PRINT
  930 PRINT"After curve drawing press an
y key to return here"
  940 PRINT:PRINT"Hold down space bar to
 abandon a curve"
  950 PRINT
  960 PRINT"Do you want to change any fa
ctor? ";
  970 REPEAT
  980 UNTIL NOT(INKEY(-99))
  990 *FX15,0
 1000 A$=GET$
 1010 IF A$="Y" PRINTA$:PROC_CHANGE : GO
TO 750
 1020 CLS
 1030 ENDPROC
 1040 :
 1050 DEF PROC_SF
 1060 SFx=((MaxX-MinX)*SFx)/1276
 1070 SFy=((MaxY-MinY)*SFy)/1016
 1080 SX=INT(SX-MinX)
 1090 SY=INT(SY-MinY)
 1100 ENDPROC
 1110 :
 1120 DEF PROC_CHANGE
 1130 PRINT"Type in C to clear out all t
he rules"
 1140 PRINT"Just press RETURN without in
puting a number to finish changes"
 1150 REPEAT
 1160 PRINT"Input number of prameter to
change, type ";MX%+5;" to add a new rule
 ";
 1170 INPUT C$
 1180 IF C$="C" MX%=0:C%=1:GOTO 1260
 1190 C%=VAL(C$)
 1200 IF C%>=MX%+5 PROC_IP("New rule for
 "):MX%=MX%+1:R$(0,MX%)=RPLY$:PROC_IP("N
ew rule is "):R$(1,MX%)=RPLY$:GOTO 1260
 1210 IF C%=1 PROC_IP("Starting angle in
 degrees "):VA=RAD(VAL(RPLY$))
 1220 IF C%=2 PROC_IP("Turning angle in
degrees "):FA=RAD(VAL(RPLY$))
 1230 IF C%=3 PROC_IP("Order of curve ")
:RD%=VAL(RPLY$):SFx=0.1:SFy=0.1
 1240 IF C%=4 PROC_IP("New axiom is "):A
X$=RPLY$
 1250 IF C%>4 PRINT "Old rule for ";R$(0
,C%-4);" is> ";R$(1,C%-4):PROC_IP("New r
ule for "+R$(0,C%-4)):R$(1,C%-4)=RPLY$
 1260 UNTIL C%=0
 1270 ENDPROC
 1280 :
 1290 DEF PROC_IP(P$)
 1300 PRINTP$;
 1310 INPUT RPLY$
 1320 ENDPROC
 1330 :
```

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```
 1340 DEF PROC_INTRO
 1350 PRINT TAB(0,3);"Universal Fractal
Curve Generator"
 1360 PRINT"By Mike Cook"
 1370 PRINT TAB(0,6);"The system works b
y specifing an Axiom or start"
 1380 PRINT"Each letter is then translat
ed according to rules"
 1390 PRINT"The rules can specify a draw
ing action or an other-rule to use"
 1400 PRINT
 1410 PRINT"Defined drawing rules are:-"
:PRINT
 1420 PRINT" F  Draw a line Forward in t
he current direction"
 1430 PRINT" f  Move forward in the curr
ent direction"
 1440 PRINT" +  Add the fixed angle to t
he current direction"
 1450 PRINT" -  Subtract the fixed angle
 to the current direction"
 1460 PRINT" |  Turn back by 180 degrees
"
 1470 PRINT" [  Save current state on th
e stack"
 1480 PRINT" ]  Remove current state fro
m the stack"
 1490 PRINT
 1500 PRINT"The system will re-scale the
 curve to fit the screen"
 1510 PRINT"This takes up to three suces
sive drawings with the same prameters"
 1520 PRINT
 1530 PRINT"Press any key to continue"
 1540 A$=GET$
 1550 ENDPROC
```

Get it right!

```
  10 =    0 0
  20 =    0 0
  30 = FA1B B
  40 = FEF6 F
  50 = 49B4 2
  60 = F952 5
  70 = D35E 0
  80 = D608 A
  90 = C7C8 8
 100 = BA17 6
 110 = FCBA 5
 120 = E716 1
 130 = 4546 0
 140 =  295 F
 150 = ABDA F
 160 =  EBE F
 170 = DD4B F
 180 = 7D05 7
 190 = D825 4
 200 = DCC6 E
 210 = BFBA A
 220 = 4C7F E
 230 = 73E4 B
 240 = E964 6
 250 = 6816 A
 260 = F851 2
 270 = 17C8 E
 280 = 84F0 D
 290 = 1D72 D
 300 = 7334 B
 310 = 226C A
 320 = 9719 F
 330 = E50A 5
 340 = 1CA5 0
 350 = F910 6
 360 = 20A5 B
 370 = 6B48 E
 380 =    0 E
 390 = FA75 D
 400 = BFBA 7
 410 = BC57 C
 420 = DDD1 3
 430 = 3CF1 3
 440 = BB79 B
 450 = 89B8 0
 460 = F2A8 6
 470 = F43E 7
 480 = 7F1D A
 490 = B760 3
 500 = FDD4 A
 510 = ED0F E
 520 = A74E D
 530 = 911A E
 540 = 49FA 0
 550 = CDC5 0
 560 = A653 C
 570 = F192 B
 580 = 19BA A
 590 = DAA4 8
 600 = A62E E
 610 = 1E38 2
 620 = D870 4
 630 = ED0F 7
 640 = 9719 4
 650 = B193 9
 660 = C531 2
 670 = 5C59 7
 680 = 7557 C
 690 =  E93 F
 700 = 50F6 B
 710 = 2B32 9
 720 = ED0F 3
 730 = 9719 3
 740 = 4208 D
 750 = 7A16 2
 760 = 315C 3
 770 = FC23 1
 780 = FF3E 9
 790 = B0E0 B
 800 = 28C7 A
 810 = 5047 6
 820 = AA05 E
 830 = FF3E 6
 840 = 41FC D
 850 = FF3E 6
 860 = 7699 7
 870 =  8E7 A
 880 = D1EE 8
 890 = 85D0 6
 900 = FF3E F
 910 = 2C83 C
 920 = FF3E 3
 930 = 3283 A
 940 = 8549 0
 950 = FF3E F
 960 = 8927 E
 970 = BFBA 4
 980 = 1068 7
 990 = 6C86 D
1000 = 77F2 E
1010 = AC45 0
1020 = 7A16 4
1030 = ED0F 0
1040 = 9719 0
1050 = 9177 B
1060 = CF21 1
1070 = 9712 D
1080 = 962F F
1090 = 1E0A E
1100 = ED0F E
1110 = 9719 3
1120 = AA21 5
1130 =  EE3 3
1140 = 8901 7
1150 = BFBA 2
1160 = 79DD 9
1170 = BB96 4
1180 = 9824 8
1190 =  3E3 8
1200 = 3A76 0
1210 = C826 F
1220 =  5F2 5
1230 = 257C 7
1240 = FD1E 4
1250 = 2B10 1
1260 =  AA7 5
1270 = ED0F 9
1280 = 9719 4
1290 = 2BC0 9
1300 = FA2D 6
1310 = 22C1 D
1320 = ED0F 1
1330 = 9719 B
1340 = 4A08 6
1350 = 8FFA 6
1360 = FC23 C
1370 = 4B3B 9
1380 = 6AD6 5
1390 = 3488 0
1400 = FF3E 7
1410 = AA9C 4
1420 = E0F8 2
1430 = A914 2
1440 = 2E25 7
1450 = FA4B 5
1460 = 8BE1 4
1470 = 25F9 4
1480 = F8B5 A
1490 = FF3E 7
1500 = 36A3 8
1510 = CEAC 7
1520 = FF3E E
1530 =  31F A
```

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MU 7

Micro law and order

Tony Leah investigates

A BBC Micro and an Archimedes are helping to add professional touches to video tapes produced by the TV unit run by West Mercia Constabulary, which covers the counties of Shropshire, Herefordshire and Worcestershire. The fully equipped studio at the police school near Droitwich turns out dozens of training tapes for the force as well as special programmes for schools and the community on legal and safety matters.

But it is only since micro technology arrived on the scene that the videos have acquired a truly professional gloss, thanks to the ability to add striking titles and special effects.

"We bought our BBC Micro five years ago", said PC Peter Wilkinson, the man responsible for post-production editing. "It was before people began using microprocessors for this type of work and we had a few problems getting started. We could put material from the micro straight on to a video tape, but we wanted to play around with it and mix it with other things.

"Fortunately we found a firm that was able to produce a genlock board for us – only a small one, but it worked. The feed was a bit weak in the way it handled colours, but it gave us some sterling performances. By today's standards it was pretty basic, but it allowed us to put lettering on our video tapes for the first time without having to buy an expensive caption generator".

The Archimedes arrived at the beginning of last year. "It has provided us with improved colour images and the opportunity to use better art packages, like Clares Artisan", said Peter "The BBC Micro had some simple art packages for cutting, pasting and that sort of thing, but they were very limited and time-consuming.

"The beauty of working with Artisan on the Archimedes is that you've got a set menu and can quickly put together the lettering and shapes you want. You can play around with a design, rub it out and start again without worrying about having to repeat a big set-up job. In contrast using some of the desktop publishing software on the BBC Micro is arduous. It does a good job but it's long-winded".

Why choose the Archimedes? "We were impressed by write-ups in magazines like *The Micro User* which pointed to its fantastic Risc chip, extremely high quality and its memory and colour graphics capabilities", said Peter. "That interested me because I didn't care about the computer's filing systems – I wanted it to give us quality graphics.

"I'd looked at other police forces who were using micros for video graphics. But the cost of their systems, by the time they'd genlocked it and put all their software together, was about £3,500 – double what our Archimedes system has cost us.

"Also I'd been very happy with my BBC Micro. My son James is a whiz with BBC Basic and he was able to write packages for everything I wanted to happen on the video screen. So I preferred to stick to the same language. Plus we buy via local authority purchasing and these people knew all about Acorn products from their dealings on behalf of schools, so that was another factor

Peter Wilkinson working on the Archimedes in the post-production control room in the decision".

Peter Wilkinson had his eyes on an Archimedes 440, but budget requirements dictated a 310 upgrade. "The art packages we have to go with it are great," he said, "but I find it very sad that there isn't more software available for the machine".

Computer-generated graphics meant Peter was at last freed from the onerous task of hand-lettering titles on to boards and photographing them. "It was stopping us from getting on with the job of film making", he said, "and while computer lettering is not as good as we would like it to be because of its square edges, it's still better than going back to a paint brush which takes 10 times as long".

In the studio control room the Archimedes is genlocked to the video editing system by a Wild Vision board. "As soon as you put a micro into a post production video suite you have to have that signal locked", said Peter. "With that done, we can easily handle information from the micro, which is usually a Basic program or Artisan, giving us credits and captions.

"We can run this material on or off as we like, or segment it and break it up. We manipulate the images and lettering until we get the desired effect".

The system also includes a clock to give a countdown at the beginning of each new micro-originated routine. "It's a little program that gives us a click down of 35 seconds, with an indent clock telling you what the programme is going to be, how long it lasts, and who made it", said Peter.

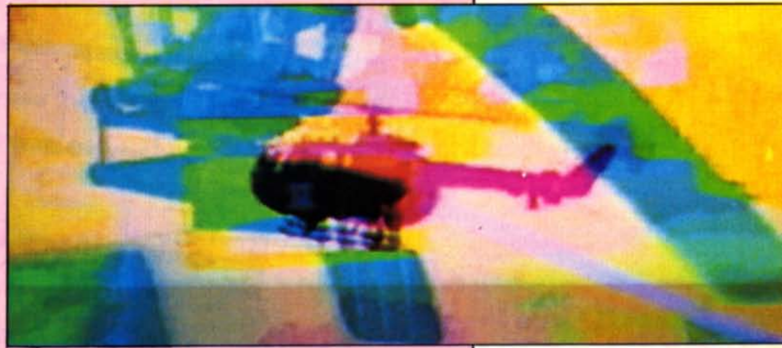
"I felt it would also be an advantage to be able to feed a video frame into the micro and manipulate it. But to do that you need something that will convert the video signal into lots of noughts and ones. Luckily we discovered the Watford Digitiser. It has a bit of trouble smoothing the picture and you can see the pixels, but it's good enough for titling and manipulating pictures to make our video packages much more interesting".

The unit had been looking at digitisers – some costing more than £3,000 – and trying to persuade the group that one would be an asset. "All of a sudden we found ourselves landed with a murder inquiry", said Peter. "We needed a digitiser in a hurry in order to look at certain pictures in a larger format and fortunately Watford Electronics was able to supply us with one of its products almost overnight.

"At that stage I hadn't got a zoom facility, and though the Watford Digitiser didn't do quite what we wanted and has since been superseded by the GML zoom machine, it handles information in such an interesting way that it operates very nicely today as a graphics creator".

One thing Peter particularly likes about the Watford Digitiser is its colour grab facility. "It produces very interesting effects when you start moving the separate images with a mouse", he said. "You can get three or four overlay images of different colours – a fantastic graphic to start your tape with.

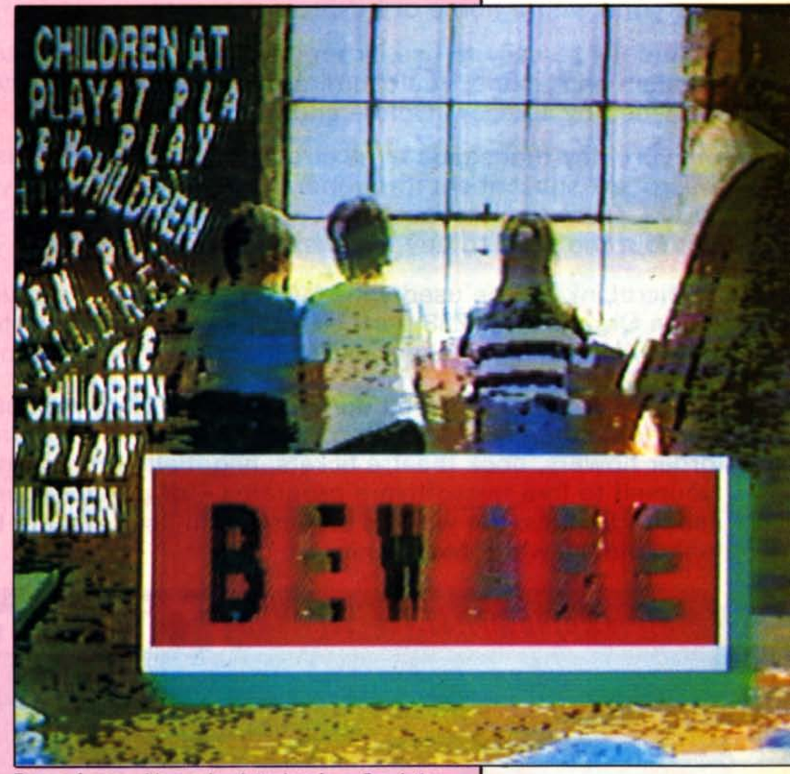
"And if you take each one of these images as a colour and put it through a time base corrector and record it on to tape you can make each one appear in turn and build up into a three colour overlay. Then you can put lettering on top of that and build up to what is not really pure animation but an interesting moving picture of graphics. Added to an effective soundtrack, graphics like these make people – particularly youngsters – sit up and pay attention.


Colour grab overlay: Continuous tape run of helicopter and three different grabs using Watford Digitiser

"It's the joining of the various bits and pieces to make a complete package that makes computer graphics for video so fascinating and which hold the interest of those watching the end product.

"Other interesting effects you can get on the Archimedes are circle flash, rotate, zoom in and out, and large size lettering.

"If a professional studio did them it would cost a fortune. We've had professionals come in here and they want to know how we get such fantastic graphics from an *ordinary* micro – they're really impressed".



Freeze frame with overlay lettering from Pro Artisan. Opening credit for Children at Play, a safety programme distributed nationally by the West Mercia Police Force

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Disarming assembly

Ian Kirk finds a way around Arm code's restrictions

IF you've written much machine code for the Archimedes you've probably come up against one of the major restrictions of the Arm instruction set. This is the inability to load *wide* numbers – ones which have set bits spanning more than eight binary positions – straight into registers. Here, though, is an effective answer. While it doesn't extend the instruction set, it lets you load any number into any register with a single assembler directive.

The magical solution can be found by typing in the listing. The function FNfulimm, the main routine, comes immediately after a quick demo program at the start. As you can see from that, it can be easily called from within the assembler and will generate one or more Arm instructions.

PROCfullinit must be called before the function is used as it sets up a few necessary variables. For the names of these and general info call PROCfullimmhelp, which is included in case you use the utility as an INSTALLed unit.

Once this call has been made the utility can be accessed whenever you desire. It needs two arguments: The standard Arm code group 1 mnemonic and the assembly option to be used. The mnemonic is passed as a string, and the only restriction placed on it is that it must have an immediate value as its final argument. The value can be as wide as needed up to the 32 bit limit imposed by the size of the registers. For example:

```
FNfulimm("MOV r5,#762585",0)
FNfulimm("SBCS res,r8,#num",pass%)
FNfulimm("RSBEQ ans,str,#num1 EOR (num2<<17)",opt%)
```

There's no need to worry about the exact sequence of instructions that will be needed as the utility takes care of that. For example it converts the instruction:

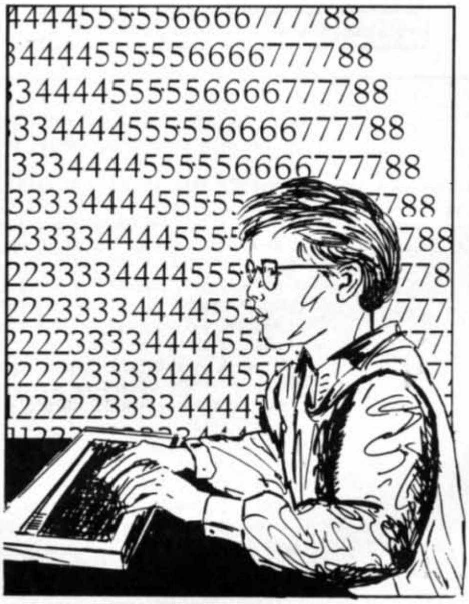
```
FNfulimm("ADCNESans,n1,#&70023F5",3)
```

to:

```
ADCNE ans,n1,#&F5
ADDNE ans,ans,#&2300
ADDNES ans,ans,#&7000000
```

Note that it only uses the register that the value is being loaded into – no others are changed at any time. Instructions where the sequence of commands are less obvious, such as RSB or MVN are coped with as easily.

The only things the utility can't cope with are the comparison instructions CMP, CMN, TEQ and TST. This is a pity, but there's simply no way of breaking one 32 bit ones into four separate 8 bit



comparisons without using extra registers to store working values and generally going to ridiculous extremes.

If you really need to compare a register to a 32 bit immediate number use the utility to load the number into a second register to compare them.

As the routine uses as few instructions as possible to load a value into a register, one thing to watch out for is a number that changes after the first assembly pass. What can happen here is that

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MAJOR VARIABLES	
instr$	Command string supplied by user
pass%	Assembly option supplied by user
opcd%	Instruction number of command to be assembled
cond%	Condition number for command
r1%, r2%	Numbers of registers to use
r1$, r1$	Names of registers –as specified by user
immed%	Value of immediate number to load
shift%	Determines which 8 bit section of *immed%* to use in instruction
first%	TRUE if first instruction in sequence being built
error%	Set TRUE if undefined variable accessed in FNsafeeval
sin$	String showing instruction just assembled
ins%	Points to copy of *instr$* in memory

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a different number of instructions will be used to load the value on the second pass, and this will mess up the addresses of any labels in the remainder of the program. There is a solution to this: Bit nine of the assembly option is used to determine whether or not the minimum number of instructions are to be used.

If this bit is clear they will be generated as efficiently as possible but if set four instructions will be used to load the value irrespective of its size any changes in the value between passes won't lead to changes in the length of the code. You can either set the bit for individual instructions like this:

```
FNfulimm("MVN res,#rand%",pass% OR &100)
```

or set it in the FOR..NEXT loop that controls the assembly:

```
FOR pass%=&100 TO &103 STEP 3
```

One final use of this utility involves the ADR pseudo-instruction which is assembled as a subtraction or addition of an immediate value from the program counter.

This is as restricted as any other, so generally only addresses within 256 bytes – 64 instructions – of the ADR can be accessed. Just use ADR with FNfulimm with the normal syntax and everything will be taken care of. As the labels used with ADR invariably change between assembly passes, four instruction assembly is automatically used in this case.

Now you can load any number into any register with one command and no headaches. Happy assembling!

```
   10 REM >FulImmDemo
   20 REM (c) The Micro User
   30 REM by Ian Kirk
   40 REM ----------------------------
   50 REM Demo program up to line 370
   60 REM ----------------------------
   70 REM This only demonstrates
   80 REM ADR, MOV and ADD
   90 MODE 12
  100 @%=&B0C
  110 PROCfullinit
  120 DIM code 10000
  130 FOR H%=1 TO 1000
  140 n1%=RND(&3FFFFFFF)*SGN(RND)
  150 n2%=RND(&3FFFFFFF)*SGN(RND)
  160 reg1=3:link=14
  170 PRINT TAB(0,0)"Random numbers are
"n1%;" and "n2%;SPC(20)
  180 FOR opt%=0 TO 2 STEP 2
  190 P%=code
  200 [OPT opt%
  210 .start
  220 FNfulimm("ADR r5,dta",opt%)
  230 FNfulimm("MOV reg1,#n1%",opt%)
  240 FNfulimm("ADDS r0,reg1,#n2%",opt%)
  250 STR r0,[r5]
  260 MOV pc,link
  270 ]
  280 dta=start+8000
  290 NEXT
  300 CALL start
  310 PRINT "Real sum = "n1%+n2%;"; mach
ine code result is "!dta;SPC(10)
  320 IF n1%+n2%<>!dta THEN PRINT ""Wron
g !!!":END ELSE PRINT "Identical"
  330 PRINT H%
  340 NEXT
  350 PRINT ""All 1000 results matched -
 I rest my case!"
  360 @%=&90A
  370 END
  380 REM >FullImmed : PROCfullimmhelp f
or info on use
  390 REM (c) The Micro User
  400 REM by Ian Kirk
  410 DEF PROCfullimmhelp
  420 SYS &44,"Routine to allow arbitary
 sized immediate constants in assembly l
anguage."+CHR$(13)
  430 SYS &44,"First call PROCfullinit a
t start of users program."+CHR$(13)
  440 SYS &44,"Then use FNfulimm(""<inst
r>|ADR reg,loc"",opt%) where <instr> is
any group 1"+CHR$(13)+"command with an i
mmediate argument except TST, TEQ, CMP o
r CMN, opt% is assembly option to use."+
CHR$(13)
  450 SYS &44,"Set bit 9 of opt% to forc
e 4 instruction assembly."+CHR$(13)
  460 SYS &44,"The immediate argument (o
r location for ADR) can be of any size <
=32 bits."+CHR$(13)+CHR$(13)
  470 SYS &44,"Reserved variables : ins%
,ropc%(),opcd$,cond$"+CHR$(13)+CHR$(13)
  480 SYS &44,"FNsafeeval(A$,error%) als
o usable; A$ is any EVALable string, 0 r
eturned & error%=TRUE if EVALing A$ gene
rates an error, otherwise correct value
returned & error%=FALSE"+CHR$(13)
  490 ENDPROC
  500 DEF PROCfullinit
  510 LOCAL A%
  520 DIM ins% 100,ropc%(15)
  530 FOR A%=0 TO 15:ropc%(A%)=A%:NEXT
  540 ropc%(3)=4:ropc%(5)=4:ropc%(6)=2:r
opc%(7)=4:ropc%(13)=12:ropc%(15)=1
  550 opcd$="ANDEORSUBRSBADDADCSBCRSCTST
TEQCMPCMNORRMOVBICMVN"
  560 cond$="EQNECSCCMIPLVSVCHILSGELTGTL
EALNVHSLO"
  570 ENDPROC
  580 DEF FNfulimm(instr$,pass%)
  590 LOCAL temp%,adrtype%,opcd%,cond%,s
p%,s%,shift%,immed%,r1%,r2%,r1$,r2$,sins
$,e%,f%
  600 LOCAL ERROR
  610 ON ERROR LOCAL REPORT:PRINT " for
instruction """;instr$;"""":END
  620 $ins%=instr$:temp%=0:WHILE ins%?te
mp%>90:ins%?temp%=ins%?temp% AND &DF:END
WHILE:instr$=$ins%
  630 adrtype%=(LEFT$(instr$,3)="ADR")
  640 opcd%=INT((INSTR(opcd$,LEFT$(instr
$,3))+2)/3-1)
  650 IF (opcd% AND 12)=8 THEN ERROR 0,"
This op code not supported"
  660 cond%=INT((INSTR(cond$,MID$(instr$
,4,2))+1)/2-1)
  670 IF cond%>15 THEN cond%-=14
  680 sp%=-(ins%?(3-2*(cond%>=0))=ASC"S"
):s%=0
  690 PROCregdecode(INSTR(instr$," "),IN
STR(instr$,","),r1%,r1$)
  700 f%=INSTR(instr$,","):e%=INSTR(inst
r$,",",f%+1)
  710 r2%=0:r2$="":IF e%>0 THEN PROCregd
ecode(f%,e%,r2%,r2$):IF opcd%>7 AND opcd
%<>12 AND opcd%<>14 THEN ERROR 0,"Need i
mmediate argument"
  720 IF adrtype% THEN
  730 immed%=FNsafeeval(MID$(instr$,INST
R(instr$,",")+1),error%)
  740 IF error% AND (pass% AND 2)=2 THEN
 ERROR 26,"Unknown or missing variable"
  750 r2%=15:r2$="PC,":IF immed%>P%+8 TH
EN opcd%=4:immed%-=P%+8 ELSE opcd%=2:imm
ed%=P%+8-immed%
  760 ELSE
  770 temp%=INSTR(instr$,"#"):IF temp%=0
 THEN ERROR 0,"Need immediate argument"
  780 immed%=FNsafeeval(MID$(instr$,temp
%+1),error%)
  790 IF error% AND (pass% AND 2)=2 THEN
 ERROR 26,"Unknown or missing variable"
  800 IF opcd%=0 THEN immed%=NOT(immed%)
:opcd%=14
  810 ENDIF
  820 IF (opcd% AND 13)=13 THEN r2%=r1%:
r2$=r1$
  830 IF ins%?(3+sp%-2*(cond%>=0))<>ASC"
" THEN ERROR 26,"Unknown or missing var
iable"
  840 IF cond%<0 THEN IF ins%?(3+sp%)=AS
C" " THEN cond%=14
  850 IF opcd%<0 THEN ERROR 1,"No such m
nemonic"
  860 shift%=0:first%=TRUE:IF (pass% AND
 &100)=&100 THEN adrtype%=TRUE
  870 REPEAT
  880 IF NOT(adrtype%) THEN WHILE immed%
>0 AND (immed% AND 3<<shift%)=0:shift%+=
2:ENDWHILE
  890 r%=((immed%>>>(shift%+8))<>0):IF N
OT(r%) THEN s%=sp%
  900 instr%=(cond%<<28)+(1<<25)+(opcd%<
<21)+(s%<<20)+(r2%<<16)+(r1%<<12)+(((16-
shift%/2) AND &F)<<8)+((immed%>>>shift%)
 AND &FF)
  910 [OPT pass%:EQUD instr%:]
  920 IF (pass% AND 1)=1 THEN
  930 sins$=MID$(opcd$,opcd%*3+1,3)
  940 IF cond%<>14 THEN sins$+=MID$(cond
$,cond%*2+1,2)
  950 IF s%=1 THEN sins$+="S"
  960 sins$+=(" "+r1$)
  970 IF opcd%<9 OR opcd%=12 THEN sins$+
=(r2$)
  980 sins$+=("#&"+STR$~(immed% AND (&FF
<<shift%)))
  990 PRINT TAB(28,VPOS-1)sins$;SPC(10)
```

Turn to Page 88 ▶

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◀ *From Page 86*

```
 1000 ENDIF
 1010 IF first% THEN
 1020 first%=FALSE:opcd%=ropc%(opcd%)
 1030 r2%=r1%:r2$=r1$
 1040 ENDIF
 1050 shift%+=8
 1060 UNTIL ((immed%>>>shift%)=0 AND NOT
(adrtype%)) OR (adrtype% AND shift%=32)
 1070 ="
 1080 DEF PROCregdecode(f%,e%,RETURN reg
%,RETURN reg$)
 1090 e%-=1
 1100 WHILE ins%?(f%)=32:f%+=1:ENDWHILE
 1110 WHILE ins%?(e%-1)=32:e%-=1:ENDWHIL
E
 1120 f%+=1:e%+=1
 1130 IF INSTR("Rr",MID$(instr$,f%,1))>0
 THEN r%=VAL(MID$(instr$,f%+1)):l%=LEN(S
TR$(r%)):IF f%+l%+1=e% AND MID$(instr$,f
%+1,l%)=STR$(r%) THEN reg%=r%:reg$="r"+S
TR$(reg%)+",":ENDPROC
 1140 IF e%=f%+2 THEN IF (ins%?(f%-1) AN
D &DF)=ASC"P" THEN IF (ins%?f% AND &DF)=
ASC"C" THEN reg%=15:reg$="PC,":ENDPROC
 1150 reg%=EVAL(MID$(instr$,f%)):reg$=MI
D$(instr$,f%,e%-f%)+","
 1160 ENDPROC
 1170 DEF FNsafeeval(n$,RETURN error%)
 1180 LOCAL ERROR
 1190 ON ERROR LOCAL error%=TRUE:=0
 1200 error%=FALSE:=EVAL(n$)
```

Get it right!

```
  10 =    0 0
  20 =    0 0
  30 =    0 0
  40 =    0 0
  50 =    0 0
  60 =    0 0
  70 =    0 0
  80 =    0 0
  90 = 3C86 6
 100 = 9859 E
 110 = 41D9 7
 120 = 61A1 B
 130 = E997 C
 140 = C5D0 D
 150 = 9B05 4
 160 = A665 5
 170 = E017 C
 180 = 5221 4
 190 = 3FB3 E
 200 = 56F6 5
 210 = 3208 9
 220 = C8D8 5
 230 = CB09 D
 240 = 9EC6 1
 250 = 7766 0
 260 = 16CD D
 270 = 8B58 2
 280 = C48A F
 290 = 2C83 8
 300 = 52E0 9
 310 = 60DE F
 320 = FCBB B
 330 = 9F9D 8
 340 = 2C83 C
 350 = F226 6
 360 = 90E2 A
 370 = FD2E 2
 380 =    0 2
 390 =    0 2
 400 =    0 2
 410 = 2CEB 4
 420 = 37A1 1
 430 = D129 F
 440 = 6FA9 4
 450 = 5579 5
 460 = 6353 5
 470 =  269 6
 480 = B654 A
 490 = ED0F F
 500 = CB16 0
 510 = 20BD 5
 520 = 4832 0
 530 = 58DE C
 540 = 4818 E
 550 = 911F 5
 560 = A255 7
 570 = ED0F C
 580 = 6C87 2
 590 = 5B88 C
 600 = A03B B
 610 = 3045 6
 620 = 994E A
 630 = 2547 4
 640 = 4399 2
 650 = DEA1 E
 660 = BB8E D
 670 = 5E0F 5
 680 = 5779 F
 690 = 72FD 5
 700 = 51BE 8
 710 = AF4D 4
 720 = 4F5E 5
 730 = A052 B
 740 = 9E0B D
 750 = 38DE 4
 760 = 18C0 9
 770 = B3B4 4
 780 = 2C34 C
 790 = 9E0B D
 800 = 8061 7
 810 =  8E1 D
 820 =  971 7
 830 = C86D 5
 840 = 67A0 4
 850 = DE48 4
 860 = 6CE5 D
 870 = BFBA A
 880 = 8A5D 9
 890 = E46B 2
 900 = B648 E
 910 =  F84 D
 920 = 8EF4 C
 930 = BE46 7
 940 = F64C F
 950 = 4D1D 0
 960 = 9D09 F
 970 = C6D6 3
 980 = F688 2
 990 = 2290 9
1000 =  8E1 A
1010 =  F58 4
1020 = FEB8 D
1030 = D63D C
1040 =  8E1 0
1050 = F2FC 8
1060 = E4A0 3
1070 = E350 6
1080 = 853D 5
1090 = 20AC D
1100 = B783 7
1110 = F6BE D
1120 = 8DB7 5
1130 = 8320 0
1140 = 38E8 8
1150 = 663C B
1160 = ED0F B
1170 = 8F3E B
1180 = A03B 4
1190 = 63DA A
1200 = E7C8 C
```

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(0480) 50595

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PUTTING · THE · FUTURE · INTO · YOUR · HANDS

SCAN LIGHT

The Hardware

Scan-Light consists of a half-width expansion board (that will fit into any Archimedes), with on board ROM software and a choice of scanners. The hand-held scanner is able to scan or digitise pictures, text, signatures, diagrams from loose pages and books at 200 dots per inch. The full width version can scan complete A4 pages of information while the half-width scanner is restricted to a scan width of 105mm (just over 4 inches).

Both scanners have a brightness control and two different scan modes—normal monochrome mode suitable for line graphics or text, and a dithered mode suitable for photographs or half tone pictures.

Scanning a document is simple, the scanner is placed at the top of the page, the scan button is held down and the scanner dragged down the page. As it moves over the document the scanned image is shown on screen and captured in the computer's memory.

The Software

All the necessary scanner controlling software is included on a ROM as part of the interface board—it does not require programs to be loaded from disc.

The software is WIMP based and completely RISCOS compatible. This ensures it is both easy to use (all its features are controlled by menu options) and that it can multi-task with other RISCOS applications and run under the RISCOS desktop. (It is also completely compatible with the older Arthur operating system). Software features include:

- A full page preview is displayed, as the image is scanned, showing the digitised image as the scan progresses down the page.
- Once scanned the image is shown full size within a re-sizeable, scrollable window. The image may be magnified or reduced by any amount from 1% to 999% of original size.
- Pixel editing facilities allow individual pixels to be drawn or "undrawn".
- A variety of printer drivers is included to transfer the image to a range of dot matrix, inkjet and laser printers.
- A special grey-scale preview mode anti-aliases the scanned image to produce a true grey-level picture, allowing near photographic quality images to be obtained.
- Scanned images, or any selected part, may be saved in a variety of ways:
  (i) As a compressed data file (saves disc space).
  (ii) As a monochrome sprite.
  (iii) As a 16 grey-level anti-aliased sprite.

The latter option is ideal for incorporating pictures or photographs into other programs such as Paint and Draw or any DTP program such as the Acorn DTP or Impression programs.

MITSUBISHI
TESTED
Scan-Light

Scan-Light

Now you have twice the choice!

Scan-Light, in conjunction with the outstanding graphics facilities available on the Archimedes, finally takes computers away from the text only background to the point where they can handle both text, graphics and digitised pictures with equal ease.

Scan-Light Junior

This half-width scanner provides a low cost alternative to the full A4 width version. It offers the same facilities and runs with exactly the same software but is limited to capturing 4 inch wide images. In addition, Scan-Light Junior offers a choice of scan resolutions from 100 dpi to ultra-high 400 dpi.

Prices

Scan-Light Junior £189.00 + VAT for half-width scanner, interface board and software.

Scan-Light £449.00 + VAT for A4 width scanner, software and interface board.

Access and Barclaycard welcome.

Scan-Light runs on both the Arthur and RISCOS operating systems, and requires a 1 MByte machine.

Money-Back Guarantee

We offer a full, no quibble, money back guarantee with Scan-Light. If for any reason you are not satisfied with this product you may return it for a full refund. This is in addition to our normal parts/labour guarantee and our free software update service.

See us at
The BBC Acorn User Show
Alexandra Palace
21-23 July 1989
Stand No. 34/36

The scanner, interface and ■ software for the Archimedes

Computer Concepts Ltd
Gaddesden Place, Hemel Hempstead, Herts HP2 6EX
Tel: Hemel Hempstead 0442 63933

Watford Electronics

Jessa House, 250 Lower High Street, Watford WD1 2AN, England
Tel: Watford (0923) 37774 Tlx: 8956095 Fax: 01 950 8989
Shop Hours: 9am to 6pm (Mon.-Sat.) Thursdays 9am to 8pm
All prices exclusive of VAT; subject to change without notice & available on request.
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The choice of Experience

The choice before and after the experience

Archimedes micro

Now supplied with the New RISC OS

System	Basic	Mono	Colour	Multiscan
305	£725	£785	£924	£1869
310	£899	£859	£1098	£1318
310M	£959	£1019	£1158	£1379
410/1	£1199	£1259	£1398	£1619
420/1	£1699	£1759	£1898	£2119
440	£2499	£2559	£2698	£2919

(Securicor carr. £10 on Archimedes)

SPECIAL OFFER

Buy an Archimedes micro from us at above prices and we will conbtribute 10% of the money you spend, towards the purchase of a printer, disc drive or any Hardware or Software of your choice.

ACCESSORIES

● NEW Multitasking RISC OS	£29
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● ROM Podule (Computer Concepts)	£45
● ROM Podule (C C) with Battery Backup	£59
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● 2 Podule Backplane (Watford)	£25
● 4 Podule Backplane (Watford)	£38
● Backplane FAN only (for Hard Disc)	£9
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● MIDI Expansion Card	£65
● Sound Sampler (Armadillo)	£129
● Chromalock Podule	£280
● 20 Mb Hard Disc & Controller Card	£469
● Watford's latest 20 Megabyte Hard Disc, Controller Card & Utilities Software	£379
● Econet Network Board	£49
● Archimedes IEEE Interface Adaptor	£269
● Dual RS232 Podule	£195
● 16 bit parallel I/O Card	£195
● PC Emulation Pack incl. MSDOS 3.21	£65
● Archimedes Reference Manual	£29
● Arm Assembly Lang. Prog. Manual	£15
● Archimedes BBC Basic Guide	£20

RISC OS Now available from stock

WORDPROCESSORS

Wordwise +	£18	Pipedream	£89
Image Writer	£25	P. Spellchecker	£40
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Viewstore	£49	System's Delta+	£60

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Intersheet ROM	£35	Viewsheet	£49
Sigmasheet			£59

BUSINESS GRAPHICS

GammaPlot	£59	Interchart ROM	£25

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Logistix – Database, Spreadsheet, Time Management & Business Graphics £94

By popular demand, we are now supplying refurbished and fully guaranteed BBC Micros with Disc Filing System

(Please telephone for price & availability)

Computer Concept's Software for Archimedes on Disc

A. Interword	£27	A. Spell-Master	£48
A. Interchart	£27	A. Intersheet	£27

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Artisan	£31	Gamma Plus	£60
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Archeffect	£20	Archeffect	£20
ArcTFS	£25	Lingenuity Presenter	£24
Render Bender	£66		

MINERVA's Archimedes Software

Sigmasheet	£57	Gammaplot	£57
Deltabase	£24	System Delta+	£69
System Delta + Reference Manual			£25
Order Processing*	£53	Sales Ledger*	£53
Stock Manager*	£53	Purchase Ledger*	£53
Nominal Ledger*	£53	Reporter	£20
School Administrator			£66

*** Requires System Delta**

Archimedes to BBC SERIAL LINK

Using this simple data link, it is possible to solve all your BBC to Archimedes data transfer problems. The kit is supplied with a disk, and the necessary cable to connect the two computers. Using this package it is possible to transfer any data from the BBC to Archimedes at upto 19200 baud.

Onlv £15

Archimedes 5¼"/3½" Disc drive Interface

With this interface it is possible to connect almost any 5¼"/3½" disc drive with its own power supply to the Archimedes. NO SOLDERING is involved. Supplied complete with necessary lead.

Only £21

Note: This is not simply a lead. Attempting to connect an external disc drive by direct connection may result in damage to your Micro.

Watford's 20Meg & 40Meg Archimedes Hard Disc

Watford Electronics' 20Meg & 40Meg hard disc fits internally into the Winchester slot provided. It is fully compatible with Acorn's hard disc upgrade, (the only difference is our low price). Price includes the Hard Disc Drive, Controller Podule & fitting instructions.
P.S. This upgrade requires a backplane and a fan.

Arch HD20 – 20Meg Hard Drive	£379
Arch HD40 – 40Meg Hard Drive	£425
Backplane for 2 Podules	£25
Backplane for 4 Podules	£38
Slimline Quiet Extractor Fan	£9

CREDIT TERMS now available.
In these days of expensive borrowing, we have negotiated a special deal for our customers, which allows us to offer you, low cost finance scheme at 12.25% per annum, typical APR 25.5%. For further details please telephone or write in.

LANGUAGES (Archimedes)

ANSI 'C'; ISO-PASCAL; FORTRAN 77; all Release II.	£94 each
Cambridge LISP; PROLOG X	£181 each
LOGOTRON LOGO	£55
BASIC Compiler	£89
Archimedes Assembler	£189
TWIN EDITOR	£27

BBC MASTER

MASTER 128K Micro incl. Acorn's: View, Viewsheet, ADFS, BASIC Editor & TERMINAL plus £35 worth of FREE OFFER (see below) **£439**

FREE . . . £50 worth of Software

Gemini's OFFICE MATE & OFFICE MASTER packages on Disc consisting of: Database, Spreadsheet, Beebplot graphics. Accounts packs: Cashbook, Final Accounts, Mailist, Easyledger, Invoice & Statements, Stock Control, and the popular, Master Advanced Reference Manual.
With every BBC Master purchased from us this month.

BBC Master with Turbo Board + above SPECIAL OFFER £535

Securicor Carriage on Micros £7

ADD-ONs & ACCESSORIES

Turbo 65C102 Add-on Module			£118
Econet Module for the Master			£49
Twin ROM Cartridge for Master			£8
Quad ROM Cartridge for Master			£12
Universal Processor Adaptor			£75
Master Reference Manual I			(No VAT) £14
Master Reference Manual II			(No VAT) £14
Master Advance Ref. Manual			(No VAT) £18
64K Upgrade Kit for B+			£32
Acorn 1770 DFS Kit complete			£49
ECONET Upgrade Kit for BBC			£42
ALL ECONET UPGRADES Available			
ARIES' Professional IEEE Interface			£238
Morley Teletext Adaptor with ATS Rom			£99
Filestore E01S	£899	Filestore E40s	£799
Filestore E60S	£1080	Ecolink	£270

BBC MASTER COMPACT

System 1	Standard Package	£305
System 1A	System 1 + TV Modulator	£329
System 2	System 1 + Green Hires Monitor	£359
System 3	System 1 + Medium Res Colour Monitor	£469
RS232 Kit for BBC Compact		£25
Additional 3½" Drive for BBC Compact		£90

(Securicor carriage £10)

65C102 2nd PROCESSOR

This amazing package consists of the Acorn 65C102 'Turbo' Board, the Watford Co-Pro Adaptor and Acorn 1.2 DNFS ROM. The 'Turbo' board, running at 4MHz with 64k of additional RAM will increase the speed by between 50 and 200% depending on the application running, and allow a BASIC program of upto 44k in any screen mode. Simply by plugging in the Co-Pro and the DNFS ROM with its special Tube host code and you massively increase the power of any Model B. This is a complete package, with its own power supply, ready to interface with your BBC Micro.

£159

Archimedes A3000 Micro

This new A3000 Archimedes is overall smaller, faster and more affordable. It is supplied with RISC OS, 8MHz ARM processor and 1MB of memory. The neat one box design incorporates a single 3.5" disc drive, parallel printer interface, sound and video outputs, and a mouse.

Price: £649

Please telephone or write in for technical brochure.

0% FINANCE

We are once again able to offer 0% finance for the purchase of an Archimedes Micro. For further details please write in or telephone 0923 37774 ext 203.

VOLTMACE JOYSTICKS

Delta 3B Single Joystick	£10
Delta 3B Twin Joysticks	£15
Delta 3C Joystick for Compact	£10
Delta 14B Single Joystick	£11
Delta 14B/1 Adaptor Module	£12
Transfer Software Disc-Tape	£7

CO-PRO Adaptor

CO PRO ADAPTOR

With this Watford's Co-pro Adaptor unit, you can now attach any BBC Master's coprocessors to your original BBC B.

Use the super fast Turbo Board with your BBC B, it is much faster than the 6502 2nd processor superseding it.

With the 512K addon your standard BBC machine achieves IBM PC compatibility at a realistic price running GEM, Lotus 123 and many other programs. Included with the 512k package is a high precision mouse and the Digital Research GEM suite of software; GEM Desktop, GEM Write GEM Paint. This requires both the 1770 DFS and the ADFS to be fitted to your computer.

To use other co-processors you require a BBC B with DNFS 1.20 or higher, or BBC B+ fitted with 1770 DFS 2.20 or greater. Co-processors work exactly like a second processor.

Master owners may use Co-Pro Adaptor to add a second Co-processor externally.

Watford, brings power to your BBC at only:

£35 (carr £5)

REPLICA 3

This new improved REPLICA 3 from Clares is a very powerful disc based TAPE to DISC Utility. It now transfers even more programs than ever before. Replica 3 will not work with all programs but then neither will anything else. 30,000 Replicas have been sold to date. It has to be good.

£15 (40 or 80 track)

NEW

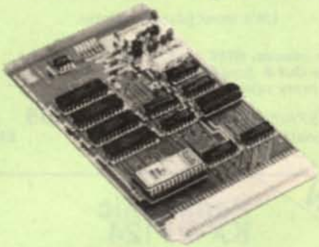
The Complete Mouse User Guide to BBC Micro

This manual has been written to reveal the secrets of the mouse. It explains all the principles required by the hardware and associated software, and also example listings for inclusion into custom programs. The manual first details the basic principles of the mouse and a simple program which uses these principles. This information should be adequate for most applications. However, it is possible to improve the performance of the mouse by expanding on the principles already used in the software. This is again fully explained and an example program given.

It is possible to gain a full understanding of the mouse from this manual. For those not interested in exactly how the mouse functions, complete example programs are also included. These may be typed directly into the micro, without the need for any understanding of the hardware or software involved, enabling the mouse to be used for custom applications.

Price	**£5.95** (No VAT)
Example programs on Disc	**£4.95**

Archimedes Real-Time Digitiser



Watfords' Archimedes Video Digitiser is the most sophisticated digitiser ever designed for a micro. It provides a fast and flexible means of capturing images from a video camera or recorder for display and manipulation on the Archimedes range of Micros. Off-air television signals may also be digitised via a video recorder or TV tuner.

Once captured, Video images can be stretched, squahsed, rotated, stored on disk, printed, or used by applications software.

Applications include desktop publishing, graphics, animation, image analysis and recognition, medical imaging, automatic inspection and measurement, databases, interactive video, remote transmission of pictures via a modem, movement detection ... or anything else you can think of!

SOFTWARE
All driver software for the digitiser is contained in a ROM on the podule. Software facilities are accessed via operating system star (*) commands and SWI calls. A Utility Disk is included containing sample pictures, examples and Utility programs.

RESOLUTION
Images are digitised to 512 (h) x 256 (v) pixels, and then scaled to fit the Archimedes' screen. It is possible to digitise to 512 x 512 pixels if the picture is stationary for about 0.1 second. 512 x 512 images can either be displayed on a MultiSync monitor, or on a normal monitor using interlacing.

Pictures are digitised to 64 levels of grey (6 bits). Note, however, that it is only possible to display all 64 levels on a monochrome monitor, or a colour monitor which has a composite (CVBS) input. For this reason, the Philips CM8533 monitor is recommended instead of the standard Archimedes monitor. It is also possible to connect both a colour and a monochrome monitor at the same time.

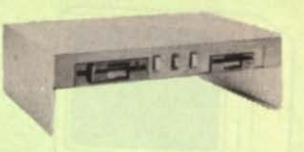
Any 2,16 or 256 colour graphics mode can be used to display digitised pictures. In two colour modes, grey levels are represented using dot patterns, which may be redefined if required (a pattern editor is supplied).

SPEED
Video fields are captured in real time (1/50th sec.), and then transferred to Archimedes' memory or the screen. The grab/display rate is dependant on the screen mode and picture size, up to 25 fields per second for quarter screen images, or 12.5 per second for fullscreen (Mode 9).

HARDWARE
The digitiser is a single width podule, with a BNC socket on the rear panel for the video input, which may optionally be terminated via a link. There is 128K of on-board memory to store the digitised image, and a 32K ROM on the podule contains all the driver software.

Price £249

Disc Drives DP35-800S



A Double disc drive – with a difference! Times are changing fast for the floppy disk, and whilst the current standard for the BBC B and Master Series is the 5.25 inch disk, the standard for the future will most certainly be the smaller; faster and more reliable 3.5 inch disks – now a standard feature of both the Master Compact and the Archimedes Series.

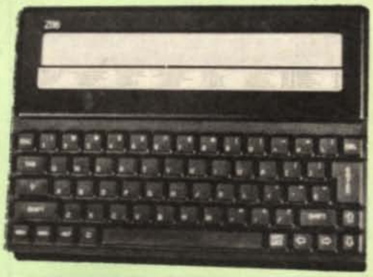
To support the present disc drive users, and cope with the future, we have designed our own plinth-mounted disk system – called the DP35 800S, it contains both the 5.25 inch and the 3.5 inch drive formats as well as offer a firm and rigid support for a monitor on top. With the BBC Micro underneath, the plinth makes a surprisingly small footprint on the desk – leaving you more space to work with.

The 5.25" disc drive is 40/80 track switchable. For ease of access, the switches are front mounted. DP35-800S has its own power supply, independent of the BBC Micro.

Watford's new plinth enables users to read, write and format disks both in DFS and ADFS format – currently the accepted standard for the Master Compact and the Archimedes, it also enables the user to read disks written for the Archimedes. Ideal for both BBC & Master.

Launch Offer: **£165** (carr. £7)

Z88 Sinclair's Portable Micro



The worlds first, truly portable Micro. It is A4 size, only an inch thick and weighs under 2lbs. Ideal for use when travelling or as a personal organiser.

Only: **£199**

FREE

With every Z88 purchased from us this month, we are giving away absolutely FREE, a Z88 to BBC Interface Link, 4 rechargeable batteries and a compact Mains Battery Charger worth £38.

ACCESSORIES

Mains Adaptor			£8.65
32K RAM Pack or 32K EPROM Pack			£17.35
128K RAM Pack or 128K EPROM Pack			£43.40
512K RAM Pack			£169
Z88 Spellmaster for Pipedream			£51
Z88 to BBC Link	£22	● Z BASE	£56
Z88 to PC Link II	£30	● Z TAPE	£42
Z88 to Macintosh	£49	● Z TERM	£42
Z88 EPROM ERASER			£34.75
Serial Printer Cable			£8.65
Parallel Printer Cable			£24.00
Z88 Modem			£145
Z88 Soft Carrying Case			£8.50
Sinclair Z88 Computing Book			£9.95
AA Nicad Rechargeable Battery			£1.50
Battery Charger, Compact & Fast (3 Hours)			£6

Continued →

MONITORS

All Monitors are supplied complete with BBC connecting leads FREE.

MICROVITEC 14"

1431 – Standard resolution as used on the BBC television computer programme	£175
1451 – Medium resolution, suitable for word processing in mode 0	£219
1441 – High res, exceeds the capabilities of the BBC micro	£359
1431AP RGB + PAL and AUDIO	£199
1451AP RGB + PAL and AUDIO	£255
2030 CS 20" Med Res	**£380**
2040 CS 20" Hi Res	**£675**
Dust Cover for Microvitecs	£5.50
Touchtec 501 Touch Screen	**£239**

14" MULTISCAN COLOUR

TAXAN Multisync 770 Plus	£439
TAXAN Multiscan 870 16" Monitor	£499
EIZO 9060S Super High resolution multiscan monitor for a wide range of applications. 800 dots x 600 lines. Display for high res VGA. 0.28 Dot pitch	£458

TAXAN 12"

Super Vision 2 **Type 620** Hi-res RGB Colour, Green/Colour Switch	£265
Super Vision 3 – **Type 625** Super Hi-res RGB Colour, Green/Colour Switch	£315

PHILLIPS

BM7502 12" Hi-res Green Monitor	£65
CM8833 14" Med. Res Colour Monitor	£219

STAR BUY

- **PHILLIPS 14"** Medium Res, dark glass, attractively finished Colour Monitor – supplied complete with RGB, SKART and Audio/Phono Inputs. A push-button switch toggles between Hi-Res monochrome green text mode and full colour display. (Please state the type of Connecting Lead you require).

ONLY £199

Dust Cover for Phillips Monitors	£6

SPARE LEADS

BNC Lead for Zenith or Philips	£3
Skart Monitor Lead	£5
RGB lead for TAXAN Monitors	£3
Archimedes Colour Monitor Lead	£7.50

SWIVEL BASES

By simply placing your monitor on one of our front adjustable professional swivel bases (see drawing at the top), you can easily adjust the monitor viewing angle.

for 12" Monitors **£8** (carr. £2.50)
for 14" Monitors **£12** (carr. £2.50)

PLOTTERS

Plotmate A4S	£379	Plotmate A3M	£549

Roland Plotters

DXY 880A	£560	DXY 1100	£630
DXY 1200	£879	DXY 1300	£1035

TAXAN KP-815 PRINTER

Offer Price £155

Taxan KP915 132 Column	**£275**
RS232 Interface	£49
RS232 Interface with 2K Buffer	£69
RS232 Interface with 16K Buffer	£89

Panasonic KX-P1081

UK's most popular printer.

(Price inludes, FREE a 4ft Printer Lead, and a Dump Out 3, Screen Dump ROM worth £35 with every printer purchased from us).

SPRING SALE OFFER only: **£139**

Optional RS232 Interface:	£39

NEW

Panasonic KX-P1124

Watford Electronics, your authorised Panasonic Premier Dealer, brings you from the prodigious Panasonic Stables, this fabulous 24-pin printer.

Available NOW at a superbly realistic price, KX-P1124 perfectly balances features, quality of construction and Value for Money to produce the printer of tomorrow, here today, ready to sweep the current generation of machines away.

At less than 53dB, this is perhaps the quietest dot matrix printer on the market.

Watford's Launch Offer: **£269**

Panasonic Printers

KX-P1180 9pin 80col. 192/38 CPS	£169
KX-P1540 24pin 136col. 240/80 CPS	£435
KX-P1592 9pin 136col. 216/45 CPS	£275
KX-P1595 9pin 136col. 288/61 CPS	£355
Panasonic KX-P4450 LASER PRINTER Latest technology at Watford's special offer price	£1,499

Spare Toner	£29	A4 Feeder	£55
Drum Unit	£149	Developer	£115

Panasonic Accessories

Cut Sheet Feeders

KX-P1592/1595 (P32)	£175;	KX-P1540 (P35)	£185
KX-P1124 (P36)	£88;	KX-P1180 (P37)	£79

BUFFERS

P12 4K Buffer Board for 1081	£55
P42 32K Buffer Chip for 1592/1595	£49
P43 32K Buffer Chip for 1540/1124	£49

Serial Interfaces

P17 P1081/1592	£32	P19 P1124/1180	£55

Original Panasonic Ribbons

Guaranteed to last 3 million characters

P110 for KX-P1081; 1592 & 1595			£8
P115 for KX-P1180	£8	P145 for KX-P1124	£8
P140 for KX-P1540	£10		

INTEGREX COLOUR JET

Colour Jet 132 Printer	£515
Paper Roll	£6.50
Screen Dump Software	£10
Colour Cartridge	£16.50
Black Cartridge	£10.35
100 A4 OHP transparencies	£55
8K Serial Interface Optional	£123
NEW – Intergrex COLOURCEL NPQ Ink Jet Colour Printer	£2,695

NEC P2200 PINWRITER

24 pin; 80 column; 168CPS – 56CPS LQ; Epson LQ compatible, 7K Buffer; 7 resident FONTS, Friction & Tractor feed, front load single sheet feed, etc. **£269**

Pinwriter Serial Interface (optional)	£55
P2200 Cut Sheet Feeder	£59
Additional Font Cartridge	£25
NEC P2200 Pinwriter Ribbon	£6
NEC Ribbons for	P6 **£8**; P7 **£9.50**

NEC PINWRITER P6/P7 Plus

NEC P6+ 80 columns	£439	**NEC P7**+ 136 columns	£575
Colour Option	£74	Serial Interface	£73
Cut Sheet Feeder	£125		

Star Printers

Star LC10	£169	LC10 Colour	£215
Star LC24-10	£279	NB24-10	£449
LC10 Colour Ribbon	£6	Cut Sheet Feeder	£65

Brother HR20 DaisyWheel Printer	**£339**

EPSON PRINTERS

EX800	£410	LQ850	£430
EX1000	£564	LQ1050	£570
FX850	£315	LQ2550	£925
FX1000	£425	LQ2500+	£839
FX1050	£439	LX800	£169
LQ500	£275	SQ2500	£975
GQ3500 Laser	£1150		

CUT SHEET FEEDERS for

EX800 **£149**; FX800/LQ800 **£149**; FX850/LQ850 **£149**; FX1000/LQ100 **£179**; LQ500/LX800 **£79**; LQ500 **£75**; LQ1050 **£175.**

TRACTOR FEED for

LQ800 **£44**; LQ850/FX850 **£69**; LQ1050/FX1050 **£85**; LQ2500 **£90**; LQ2550 **£90**

ACCESSORIES

EX800/1000 Colour Option	£55
EX800/1000 Colour Ribbon	£18
LQ2500 Colour Option	£65

(Securicor Carriage on Printers £7

EPSON PRINTER INTERFACES

All these interfaces fit inside the printer.

RS232	£32	RS232 + 2K Buffer	£52
IEEE 488	£40	RS232 + 8K Buffer	£79

PRINTER LEADS

BBC Centronics 4' long	£5
BBC Centronics 6' extra long	£7
Compact's Special Centronics Lead	£7
Archimedes Printer Lead 1 meter	£6
Nimbus Centronics Lead	£12
IBM Parallel Lead 1 meter	£6
Double Ended 36 way Centronic Lead 4'	£7
Double Ended 36 way Centronics Lead 6'	£9
MSX Centronics Parallel Lead 4'	£12
RS232 Leads (Various)	P.O.A.

RS-232 GENDER CHANGERS

Male to Female	£4.95
Male to Male	£4.95
Female to Female	£4.95
25 way Male to 9 way Female	£4.90

Listing Paper (Perforated)

● 1,000 Sheets 9½" × 11" Fanfold Paper	£7
● 2,000 Sheets 9½" × 11" Fanfold Paper	£12
● 1000 Sheets 9½" x 11" NCR 2 Part Fanfold	£19
● 1,000 Sheets 15" × 11" Fanfold Paper	£9
● 1000 Sheets true A4 Fanfold Paper 70gms	£11
● 2000 Sheets true A4 Fanfold Paper 70gms	£19
● Teleprinter Roll (Econo paper)	£4

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached).

Carriage 1K Sheets £2.50. 2K Sheets £3.00

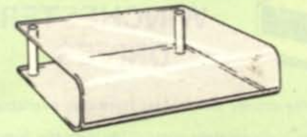
PRINTER LABELS

(On continuous fanfold backing sheet)

1,000 90 × 36mm (Single Row)	£5.00
1,000 90 × 36mm (Twin Row)	£4.90
1,000 90 × 49mm (Twin Row)	£7.50
1,000 102 × 36mm (Twin Row)	£6.25

Carriage on 1,000 Labels £1.00

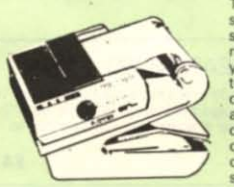
Perspex Printer Stand



Give your Computer System a touch of Class with our elegant, smoke finished Perspex Printer stand. The printer sits on top and the fanfold paper rests neatly underneath, thus occupying the same space as the printer footprint.

Only: £16 (carr. £3)

Professional Printer Stand



This new professional printer stand takes hardly more space than your printer. Due to the positioning of the paper feed and re-fold compartments ie. one above the other, the desk space required for your printer functions is effectively halved. Additional facilities include: Easy access to paper from both sides, used with both top and bottom feed paper and with its dial controlled paper feed system with adjustable deflector plates it ensures smooth paper flow and automatic refolding.

***80 Column version £23** (carr. £3)*
***132 Column version £26** (carr. £3)*

PRINTER RIBBONS & VARIOUS DUST COVERS

Type	Ribbons	Dust Covers
Brother HR15/20	£3.00	–
BBC Micro	–	£3.50
BBC Master	–	£4.00
Archimedes Micro pair	–	£9.00
IBM PCs pair	–	£6.00
RX/FX80/MX80	£3.00	
DMP2000	£3.75	£4.75
EX/LQ800	£4.50	£4.50
EX/LQ1000	£7.50	£5.00
RX/FX80/85/800/MX80	£3.90	–
RX/FX100/1000	£5.75	–
Kaga/Taxan KP810/815	£4.90	£4.00
LC10 (Black)	£4.25	£5.00
LQ500/800	£3.75	£5.00
LQ1050/LQ2500	£8.50	£5.50
LX80/86/800	£3.80	£4.50
M1009/GLP	£3.80	£3.75
Panasonic KX1080/81	£4.00	£4.75
SQ2500	£23.00	£5.50
Star NL10	£3.75	£4.50
Olivetti Ink Jet Cartridges (set of 4)	£9	

Our attractive Dust Covers are manufactured from translucent PVC. The seams are stitched and edges are taped to prevent splitting due to continuous use.

Universal Printer Sharers/Changers

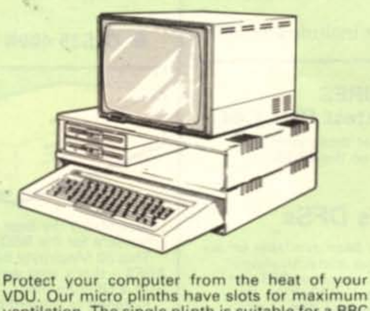
Connect upto 5 Micros to 1 printer or 5 Printers to 1 Micro with our combined, Sharer/Changer. These Units are made to a very high standard. For extreme reliability, they all have Printed Circuit Boards mounted inside the case, (not a Spagetti Junction of wires). Internal connection is made via high quality ribbon cables.

(Ideal for School environments.)

Connects	Serial	Centronics
2 to 1	£20	£22
3 to 1	£27	£30
5 to 1	£36	£39

(Cables extra at £6 each. Please specify type required when ordering)

PLINTHS FOR BBC MICRO, MASTER & PRINTERS



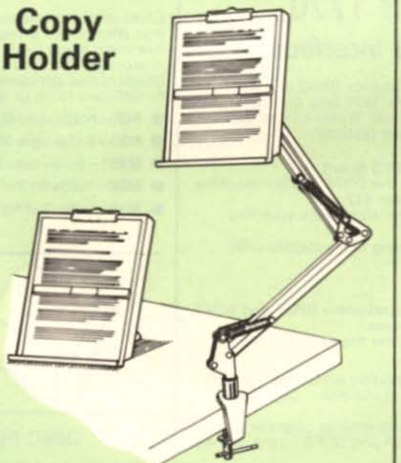
Protect your computer from the heat of your VDU. Our micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and VDU, whilst the double height version provides enough room for our stacked disc drive and other peripherals like, Eprom programmer, music unit or simply discs & stationary. The computer slides neatly in the lower section allowing easy access to remove the lid.

The single printer stand is equally sturdy but instead of cooling slots it has elegant cutouts on the sides. This allows easy access to paper from all sides. Colour: BBC Beige.

Single BBC Plinth	420 x 310 x 105mm	**£12**
Double BBC Plinth	420 x 310 x 210mm	**£20**
Printer Plinth	420 x 310 x 105mm	**£12**
Single Master Plinth	490 x 310 x 105mm	**£13**
Double Master Plinth	490 x 310 x 210mm	**£24**

(Carr. Single plinth £2; double plinth £3)

Copy Holder



Whether you want to type in your latest program or the draft of a new trilogy, Watford's manuscript holders are superb for holding your paper at the ideal height and angle to allow you to read and type in ease and comfort.

Available in 2 full A4 versions, desk resting and shelf clamping. Paper is held firmly by means of a plastic retaining ruler and a clip grip. (for resting books or magazines, the desk top version is recommended).

Desk Top **£7** (carr. £3)
Angle poise **£12** (carr. £3)

NEW

Handy 2 Way Printer Switch

A handy two way compact printer switch that enables you to connect 2 Micros to 1 printer, or 2 printers to 1 Micro. Attaches easily to your printer, monitor, etc. A low cost solution for educational establishments. Ideal for those wishing to use a dot matrix and a laser printer. Available in two configurations.

Compact AB Switch Centronics	**£20**
Compact AB Switch RS232	**£19**

(Cables extra at £6 each)

MEGABUFFER 256

The Smallest 256K Printer Buffer Unit in the world **38mm x 130mm x 134mm**.

This new Megabuffer 256 from Watford is a full featured 256K Printer Buffer. The features are:

- ● Improves efficiency by making more efficient use of computer and printer.
- ● Compatible with any computer and printer that uses Centronics Parallel connections including all BBCs, IBM PCs, etc.
- ● Total compatibility with all software.
- ● Cheaper phone bills when using your Modems.
- ● Ideal for those doing large graphics screen dumps that are slow to print.
- ● Multi-Copy facility allows you to print several copies via Megabuffer without going through your computer.
- ● Data Dump facility is included.
- ● Built in test unit for both the buffer & your printer.

Only £149 (carr £5)

THE EPSON RX-FX-KAGA PRINTER COMMANDS REVEALED

So you bought yourself a new printer, because the salesman in the shop showed you how clever it is and impressed you with all sorts of printouts to show its capabilities – he may even have offered you a special price.

However, now that you have got it home and connected it to your BBC microcomputer, you are wondering how to make it perform these magical tasks. The manual seems to give no clues, and when you type in the example programs, the computer throws the LPRINT statements back in your face.

Now what do you do, when this £400 piece of high technology refuses even to move its head, and you have stayed up until 2 in the morning with copious supplies of coffee, desperately trying to print something out. Once again, Watford Electronics comes to your help with our new book entitled 'THE EPSON FX-KAGA PRINTER COMMANDS REVEALED'.

This book describes in plain, easy to understand English, how to use and make the most of your KP810, PW1080A or any other Epson FX80 compatible Printers like Panasonic KX-P1080/1, etc., with the BBC Micro, both from BASIC and Wordwise.

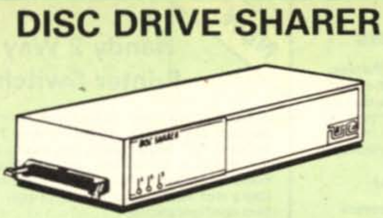
It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

£5.95 (No VAT)

CREDIT CARD 24 HOUR
Ansaphone Hot Lines
(0923) 50234 or 33383

Continued

DISC DRIVE SHARER



(Ideal for educational establishments)

At last, a low cost alternative to the Econet system. Watford's Intelligent Disc Drive Sharer allows you to connect 3 BBC micros (model B, B+ and Master series) to a single or double disc drive. Running under any DFS or DDFS, this intelligent unit will automatically queue the computers. Each computer has a status light dedicated to it. If it is green you will get immediate access to the disk, and red means that you are next in line. The unit plugs directly into the disc drive socket on each computer and is powered by the mains. (N.B. Not for use with ADFS.)

Launch Price: **£65** Price includes 3 Cables

NOW WITH EXTRA FEATURES AT NO EXTRA COST – Watford's latest DFS 1.44

- Incorporates Acorn's Official Tube Host Code so that those with 2nd processors no longer need to waste a ROM socket on the DNFS.
- Option to DOUBLE the speed of BPUT and BGET.

WATFORD's & ACORN's DFSs

Watford's popular and widely acclaimed DFS has now been available for six years and has gained a large following amongst serious and educational users of the BBC Micro. Owners of Acorn or any other standard DFS can upgrade to our "Ultimate" DFS merely by replacing their DFS ROM. See below for this upgrade. ***(P.S. Watford's highly sophisticated DFS is fully compatible with Acorn standard DFS). (while Acorn's 1770 DFS is fully compatible with Watford's Mk II DDFS)***

- *Watford's sophisticated DFS ROM only* **£16**
- *We will exchange your existing DFS ROM for Watford's Ultimate DFS ROM for only* **£12**
- *DFS Manual (Comprehensive)* *(no VAT)* **£6.95**
- *DNFS ROM only* **£17**
- *ADFS ROM only* **£25**

(P.S. Our DFS manual is the only comprehensive Manual available for the BBC micro and covers both Acorn & Watford DFSs).

(The Single Density DFS system is now old technology. Like Acorn, Watford too have decided to replace it with their more up-to-date 1770 DDFS interface. We have informed most of the software houses of this decision in order that they can ensure compatibility with our highly sophisticated and fully Acorn compatible DDFS).

NEW

Watford's MkII 1770

Double Density DFS Interface

Many of our customers have wanted to use our superior DDFS and Acorn ADFS together. Now our Mk II DDFS Board with its 1770 Disc Controller, has been adapted to allow the use of Acorn ADFS as well. It also has all the commands of the Acorn's 1770 DFS, plus the added features:

Added features include:

- Acorn ADFS compatible – Use ADFS on our DDFS board.
- Tube host Code – No longer any need to have the DNFS in your machine to use Co-Processors, even the CoPro and Master 512.
- Auto 40-80 Track sensing – no need to fuss with 40/80 track switches (even works with protected disks).
- An extremely powerful 8271 emulation – ensuring compatibility with almost all software.
- New low profile – small footprint board.
- Fits with all third party ROM boards.
- Option to double the speed of file handling operations – BPUT and BGET.
- Operates in both single and double density modes.
- OSGBPB has been recoded, increasing still further the speed of file handling.

Please note that not all DDFS's are capable of providing either the full 80% storage increase or of allowing a file the full size of the disk – Ours allows both of these!

If you already have a DDFS (any manufacturer), and wish to upgrade to our MkII version, then simply return your existing ROM and DDFS board and we will supply the new DDFS for only **£30.00**.

- Special introductory offer **£39.00**
- DDFS Manual (No VAT) **£6.95**
  - We will exchange your existing DFS Kit for our sophisticated DDFS for only **£25.00**

Please note, as the MkII DDFS is a hardware and software upgrade, it is not possible for existing Watford DDFS users to simply exchange their ROM for the new version.

DUST COVERS (For our Disc Drives)

Single CLS (without PSU) **£3.20** Twin CLD (without PSU) **£3.85**
Single CS (with PSU) **£3.95** Twin CD (with PSU) **£3.90**

Special 40/80 Disc Drive/DDFS Mk II Offer

- The popular 40/80 track 400K single Disc Drive, Double Sided, cased with Cables. Plugs directly to your Micro.
- Watford's extremely popular DDFS Disc Interface (allows 720K storage). Will run in both, Single & Double Density modes.
- A comprehensive User Friendly Manual.

A Bargain at Only **£123** (£7 carr) (Offer valid while stocks last)

3½" DISC DRIVE OFFER

These top quality 3½" Double sided, 80 track, 1 Megabyte (unformatted each Disc Drives), are attractively finished in BBC beige. They are supplied complete with all cables and a Utilities Disc. They run directly from the BBC B/Master's own PSU.

- **CLS35 400K Unit £69**
- **CLD35 800K Unit £125**

WATFORD's WINCHESTER DRIVES

Undoubtedly the best value for money Winchester Hard disc available anywhere for the BBC Micro.

This 30 Megabyte hard disc is completely compatible with the Acorn ADFS – that's why we have bundled it with each Winchester drive, along with a Utilities Disc.

Finished in rugged metal and fetching BBC beige, the Winchester has an internal fan, so quiet you won't even hear it! A switched mode power supply and a neon-lit on/off switch are there along with a light on the hard disc to tell you when it is working – just compare the price with our competitors' 20 or 28 Mbyte discs!

Compatible with the Master, and the BBc B (with 17 X disc interface).

- 30 Megabyte BBC Hard Disc **£405** (carr £9)

FLOPPY HEAD CLEANER KIT

The heads in floppy drives are precision made and very sensitive to dirt. The use of a cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. It is very simple to use. Available in 3½" & 5¼", please specify.

£4

ANTISTATIC LOCKABLE DISC STORAGE UNITS

Gives double protection – Strong plastic case that affords real protection to your discs. Antistatic helps avoid data corruption whilst in storage. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.

● **M35** - holds upto 50 5¼" discs	**£4.95**
● **M85** – holds upto 95 5¼" discs	**£6.95**
● **M25*** – holds upto 25 3 ½" Discs	**£4.95**
● **M50** – holds 50 3½" Discs	**£6.50**
● **M10** – holds 8 of No. 10 Data Cartridges	**£15**

* Not lockable

PLASTIC LIBRARY CASES

Holds up to 10 5¼" Discs. **Only £2.00**

DISC PLONKER RACK

When using ones micro, there is a tendancy to have more than one Disc on the desk. This exposes them to the hazards of fingerprints, scratches, dust, coffee and an untidy desk.

Why not protect your valuable data from all these hazards with the help of our extremely handy and low cost DISC PLONKER RACK. Holds upto eight 5¼" discs

Protection at Only: **£2**

DISC ALBUMS

Attractively finished in black leather look vinyl. Stores upto 20 Discs. Each disc can be seen through the clear view pocket.

£4

Quality Disc Drives from Watford

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.

The first capacity given in the first column indicates capacity in single density mode. That within the brackets is the capacity in double density mode. All disc drive type numbers start with the prefix "C".

The tinting on some of the boxes is used to indicate which Drives are 40 track (non-tinted) and which are 80 track (tinted). All our 80 track drives are already fitted with a 40-80 select switch.

***All our Disc Drives are Double Sided and will operate in both Single and Double Density modes.** Extensive experience of the usage of disc drives suggests that the JAPANESE drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.*

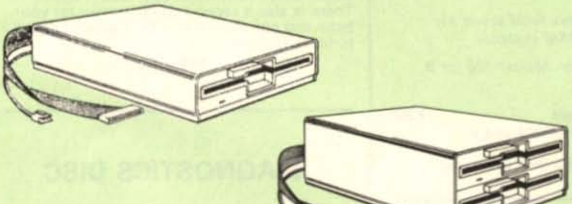
Various UK "manufacturers" of disc drives for the BBC micro (more accurately, "packages" label other manufacturers drives with their own name). We buy the high quality NEC and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.

If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.

Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate (extensive tests within our workshops have confirmed this). All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. Ideal for Schools & Colleges. We are now able to supply all single disc drives with Power Supply, in either single or dual case. (Dual case has a twin data cable and a power supply capable of driving two disc drives) allows easy expansion to a dual drive unit, at a later date. Prices stated in the pricing boxes below are for single drives in standard single cases. Single drives in a dual case cost an extra £10. (At Watford we anticipate your needs of tomorrow, not just today)!

When using a BBC Micro, most people find themselves short of desk space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space) your BBC, Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with Watford plinth. (Turn to the 4th page of our advert for the Plinths).
P.S. All our 5¼" Disc Drives with PSU are compatible with the Compact Micro. All you require is the special Compact Disc Drive Cables designed by us.

Our Disc Drives conform to BS415



"Test Bureau Approved for Use in Education"

Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
400K (720K)	CLS400S £79	CLD 400 £168	CS 400S £89	CD400 £188
800K (1.44M)		CLD 800S £159		CD 800S £169

- TWIN Disc Drive Case, complete with Power Supply & Cables **£43**

Securicor carriage on Disc Drives £5 to £6

*Prefix **C** = Cased Drive*
***L** = Less PSU*
***S** = Single*
***D** = Double*

*Suffix **S** = 40-80 Switchable*

e.g. CLS400S = Cased Disc Drive, Less power supply unit, single 5¼" 400K, (720K in double density); Double sided; 40/80 track switchable.

Cable to connect 5¼" Disc Drives to BBC Compact
Single £9 Twin £12
Special Cable to connect both 3½" and 5¼" Disc Drives simultaneously to the BBC Compact £13

Mysteries of Disc Drives & DFS Revealed

Are you tired of faulty cassettes, and lengthy loading times? Do you want to upgrade your BBC micro to take discs but you get tied up in the plethora of jargon surrounding the choice and use of these systems.

Then The Mysteries of Disc Drives and DFS Revealed is the book for you. It explains in detail the different types of systems available, how they are installed and how to use them. Many examples are given including pre-written programs to call various functions of the DFS available only through Operating System calls. Different types of disc, 40/80 tracks etc. are all explained. This book is ideal for the beginner confused by the plethora of choice available in the marketplace.

£5.95 (Book No VAT)

3M – DISKETTES

3M – SCOTCH Diskettes with Lifetime warranty from Watford Electronics your 3M Appointed Distributor.

● *10 × 5.25" S/S D/D 40 Track Diskettes (744)*	***£6.00***
● *10 × 5.25" D/S D/D 40 Track Diskettes (745)*	***£7.00***
● *10 × 5.25" S/S D/D 80 Track Diskettes (746)*	***£11.50***
● *10 × 5.25" D/S D/D 80 Track Diskettes (747)*	***£11.00***
● *10 × 5.25" 1.6M D/S D/D High Density Discs for IBM XT and AT*	***£16***
● *10 × 3.5" S/S D/D 40/80 track Discs*	***£10.00***
● *10 × 3.5" D/S D/D 40/80 track Discs*	***£11.75***
● *10 × 3.5" High Density Diskettes*	***£25***

FREE Designer Watch OFFER

Purchase any 5 packs of the above 3M Diskettes from us during the months of May & June '89, and qualify for a FREE 3M's attractive Black Designer's watch.
(Offer subject to availability)

TOP QUALITY 3.5" & 5.25" DISKETTES

To complement our range of Quality Discs and Disc Drives, WE are now supplying SPECIAL OFFER packs of 10 Lifetime guaranteed discs. Each disc has a reinforced hub ring. Supplied complete with selfstick labels and a Plastic Library Disc Box.

● *10 × **M3** 3.5" D/S D/D 80 Track Discs*	***£10***
● *10 × **M9** 3.5" Double Side High Density*	***£25***
● *10 × **M4** 5.25" S/S D/D 40 Track Discs*	***£5***
● *10 × **M5** 5.25" D/S D/D 40 Track Discs*	***£7***
● *10 × **M7** 5.25" D/S D/D 80 Track Discs*	***£9***
● *10 × **M8** 5.25" D/S H/D Hi-Density Discs*	***£14***
● *3" Double Sided Discs*	***£2.50** each*

Special BULK OFFER on 5¼" DISCS

PRICES SLASHED

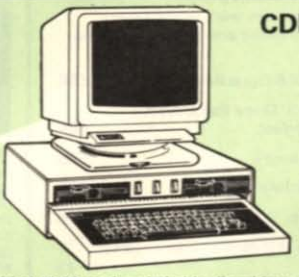
(Supplied packed in Anti-Static Lockable Storage Units)
(Lifetime warranty on Discs)

BULK PACK DISCS in lots of 100

Type	S-S 40T	D-S 40T	D-S 80T
● Without Sleeves	£35	£39	£45
● With Sleeves	£38	£42	£48

DP35-800S

CDPM800S



Twin 800K Double sided 40-80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC Micro. Supplied complete with integral power supply, cables and Utilities disc. The mains switch with neon On/Off light indicator, and the two 40/80 track switches are mounted on the front panel for ease of use.

CDPM 800S for the BBC & Master £182
DP35-800 for BBC/Master £165
(For DP35-800S spec. see Page 2 of our advert)
(Securicor Carr. £7)

(The above drive units are 2 Megabytes unformatted)

Continued ⟶

QUEST
MOUSE Mk II

QUEST MOUSE Mk II

The ultimate in Mouse technology, the Watford Electronics Quest Mouse must be the most powerful Mouse package yet produced for the BBC Micro. Featuring state of the art 32K ROM software the Quest Mouse package is filled with features essential to the budding artist. The Quest Mouse is a high precision, low profile and large footprint mouse. It has three large comfortable buttons and its RUBBER COATED STEEL BALL is smooth and easy to use on virtually any work surface. This also eliminates any directional bias that one encounters on the most well-known mouse for the BBC. The Quest Mouse is FULLY HARDWARE COMPATIBLE with the AMX MOUSE so that it will work with any of the AMX range of software.

The two parts of the Quest package are available separately so that existing Mouse owners can upgrade to the Watford's sophisticated Quest Paint software or replace their existing worn out mice for a minimum cost.

QUEST PAINT

The software is used to draw high resolution Mode 1 pictures in full colour. All menu selection and control of the drawing process is performed with the mouse so that you will hardly ever touch the keyboard.

SOFTWARE FEATURES

The software is far too powerful for us to describe it fully in such a small space. Below is a list of the various features. Please write to us for a fully descriptive leaflet.

Disk interface not required. Utilities disk has facility to create and print big screens. Colours applied can be solid, either pattern of user defined pattern. Drawing can use brush or airbrush. Brush shapes can be defined and stored. Airbrush sprays colour/pattern randomly with four jet sizes and even or center spread. Colour cycles. Colour protection to stop particular colours from being overwritten by selected drawing actions. All standard drawing facilities like: rubber, straight pencil lines, triangles, circles, ellipses, rectangles, parallelograms, polygons, etc are provided. All shapes can be solid or just a boundary line. Once a shape has been set up it can be repeated anywhere on the screen. Global colour replace in a rectangle. Powerful fill facility for areas and vertical/horizontal lines. Full cut and paste of rectangular areas with rotation and size with screens from Watford Beeb Video digitiser. Load and Save screens with colour pallet information, save brush and pattern definitions etc.

● Quest Mouse II & Quest Paint	£58
● Quest Mouse II, Quest Paint, AMX Stop Press & Pagefont	£89
● Quest Mouse II only	£29
● Quest Paint Software only	£34
● Quest Font Disc	£15
● Quest Mouse Mat (Red or Blue or Green please specify)	£3
● Part Exchange your unreliable AMX Mouse for a Quest Mouse for only	£22
● GXR ROM for the BBC Micro	£22

(P.S. Quest Paint is not compatible with BBC Compact)

N.B.
1. Quest Paint supplied complete with Software in a 32K ROM, Comprehensive User Guide and a Utility Disc.
2. Quest Font Disc has 22 text FONTS for use within Quest Mouse.

ConQuest

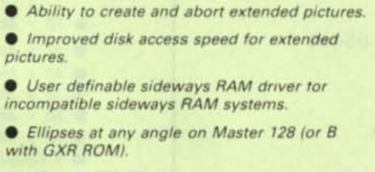
Watford's Quest package is an extremely powerful and flexible drawing package, with very wide and unusual features. However, since its launch various suggestions for even more advanced & powerful facilities were received from the Quest users. ConQuest allows you these more advanced facilities, like, distortion of a cutout to any shape and a full font designer. If you also have a GXR ROM in your machine or you are using a BBC Master then ConQuest will take advantage of this to give ellipses at any angle, sectors and arcs, etc. Quest combined with ConQuest and Acornsoft GXR ROM make up THE MOST POWERFUL drawing packages available for the BBC range. Quest Paint is able to take advantage of almost any additions to your machine, such as Shadow or Sideways RAM. ConQuest takes this principal even further, by utilising the otherwise normally incompatible Sideways RAM facility by holding pictures in them.
Some of the features are:

- *Pick filenames off the screen for loading and saving.*
- *Rotate a cutout to any angle and Distort it to any four sided shape.*
- *Has Built in Font editor.*
- *Default brushes and patterns on startup.*
- *16 x 16 font available on start up.*
- *Ability to reset patterns, fonts and brushes to default at any time.*
- *ROM based enhanced Epson and compatible printer dump.*
- *ROM based enhanced extended picture routine.*
- *Ability to create and abort extended pictures.*
- *Improved disk access speed for extended pictures.*
- *User definable sideways RAM driver for incompatible sideways RAM systems.*
- *Ellipses at any angle on Master 128 (or B with GXR ROM).*

ConQuest ROM Package	**£30**

(Price includes software in ROM and a comprehensive Manual).
(Not Compatible with BBC Compact)

MARK II LIGHT PEN



Our Mark II Light Pen is the very latest in light pen technology. It is totally insensitive to local lighting conditions and works with many different monitors. The pen only responds to the High Frequency light produced by your monitor/TV. An LED indicates when valid video data is being produced. A conveniently located switch is also fitted.

Price Only £21

FLEET STREET EDITOR

Software pack for BBC Micro	£33
Software pack for the Master	£39
Software Pack for Compact	£40
Admin Xtra Disc Utility	£13
Walt Disney Disc Utility	£13
Fonts N Graphics Disc Utility	£13

RB2 Marconi
TRACKER BALL

RB2 (AMX/Quest compatible)	£45
RB2 including Quest Paint	£75

THE NEW Mk III AMX MOUSE

ONLY: £59 Inc. Super Art package
(carr £3)
(Please specify for BBC, Master or Compact)

MOUSE MAT	£3
AMX MOUSE ONLY	£29
AMX UTILITY Package	£13
AMX SUPERART Package	£34
AMX STOP PRESS – A Desktop publising software. Works with Keyboard, Joystick or a mouse	£32
PAGE-FONTS – Over 20 Fonts for use with AMX Pagemaker	**£13**
AMX DESIGN (ROM)	£55
AMX XAM Educational	£15
AMX EXTRA EXTRA	£16
AMX MAX A gem of desktop (ROM)	£15

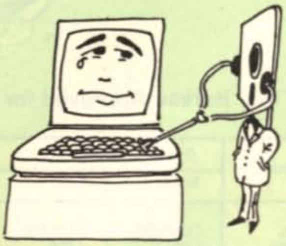
NEW

WE MOUSE HOUSE

Treat your mouse to a cosy Mouse House. This handy little gadget solves the problem of where to store your mouse when it is having a rest. Made of sturdy plastic, the WE Mouse House attaches to the side of your computer, Monitor, disc drive or desk.
It protects it from damage when not in use, yet within easy reach when you need it again. There is also a second compartment for your pens and pencils – and at £4 it doesn't cost a rodent's ransom.

Price £4

DIAGNOSTICS DISC



The BBC Micro is a very complex machine and thus diagnosing a fault can be very difficult.
At Watford Electronics, we realise how difficult it can be when faced with a problem, finding yourself a long way from your nearest dealer, or even just uncertain about your Beeb's health, but not wanting to waste time and money taking it to be looked at.
The solution to these problems is here now, in the form of the Watford's Diagnostics Disc. This excellent utility is specially designed to test out the following areas of your Beeb:
RAMs, ROMs, ULAs, Sound, Keyboard, Disc, RS423, ADC, User Port, Printer Port, Cassette, Joysticks, Speech, Disc Drives, 6502 and Z80 2nd Processors.
This utility is an invaluable aid for all those who take the reliability of their system seriously. A comprehensive manual provides full operating details and a list of possible causes and remedies for any faults that you may find along the way. The package also enables a permanent equipment and service record to be maintained.

Only £20.00

BEEB VIDEO DIGITISER

"Test Bureau Approved for Use in Education"

Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro.

This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket.

Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem.

The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.

Both the black and white levels can be adjusted manually for the optimum picture, or switched to automatic for unattended use. The image produced can be reversed if necessary.

Full controlling software is supplied on a normal sideways ROM and this is easily accessed via additional * commands. The package i designed to allow easy input of complex screens and give full access of the data to the user. Once on the screen, the image can be used as a normal graphics screen, allowing any of the usual graphics commands in BASIC or other ROMs to work on it.

A special print dump routine is included with the driver programs. This is specially designed to produce a fast, correctly proportioned picture, with reduced "contouring", resulting in an accurate reproduction of the original image.

Detailed examples of driving this unit from BASIC or other languages are all provided in the extensive manual supplied.

£109 (Carr. £5)

(Price includes) Digitiser Unit, Software in ROM & a Comprehensive Manual)
(BBC B+ and Master compatible, except Master with Econet)

Magazine Maker

(As seen on TV)

A combination of the Pagemaker and Watford's Beeb Video Digitiser.

Using any video that provides a composite signal and the digitiser, images from a camera or TV can be converted into a graphics screen on the BBC Micro.

They can then be used within Stop Press to illustrate magazines or newsletters – in fact anything that needs to be created on A4 size paper.

With Stop Press's many features, a variety of pictures can be composed – the only limit being the imagination.

Pictures can be doctored using Stop Press's graphics option to produce any number of effects.

Text can be formatted around the digitised photo on screen using the facilities available, which include 16 typefaces, character and pattern definer, text formatting and the ability to load in wordwise and viewfiles plus much more.

Once created the picture can be printed out. The Magazine Maker is suitable for any use that requires illustrated documents.

Complete Package **£135.00** (carr. £3)

WAPPING EDITOR
"MIGHTIER THAN THE QUILL"

Watford Electronics bring professional quality Desktop Publishing to the Beeb. The Wapping Editor is a totally self contained mouse-driven desktop publishing package designed to run on the BBC B, B+ and Master computers. The massive 64K Rom contains ALL the software you need to do your own publishing. It 'Brings the Freedom of Press' to your fingertip. The software has a word processor, a graphics package, a page layout section and a font designer. Although very sophisticated, Wapping Editor is simplicity itself to use. Anyone already familiar with Quest Paint will immediately feel at home.

GRAPHICS PACKAGE

Imagine Quest Paint re-written to take advantage of the high resolution of Mode 0, well this is it. The Wapping Editor could well be worth buying for this facility alone. This must surely be the graphics.

WORD PROCESSOR

This section is a fully functional word processor specially tailored to suit the Desktop Publishing environment. Gone are all the unnecessary and cumbersome text formatting commands – these are dealt with in the 'Page-Layout' section. The features of this word processor include wordwrap, wordcount, insert/overwrite, move block, copy block, delete block, search and replace, browse, etc, many of these features being mouse controlled. Text input can of course be taken from existing word processor files like Wordwise, View, etc, but it is not necessary to have a separate word processor in order to use this package.

PAGE-LAYOUT SECTION

Page Layout becomes easy using these mouse-driven routines. The user simply 'pulls' a rectangle onto the page and states which text document or graphic is required to fill the space – it's as simple as that! Text can be automatically printed in a pre-set number of columns, left justified and/or right justified, or centered. Several different typefaces can be held in memory at one time. Graphics may be stretched, squahsed or cropped to fit any size rectangle. Graphics input can be from the software provided in the package or, using the 'mode convert', from any graphics mode screen.

THE FONT EDITOR

This is an enhanced version of the font editor contained in the Con-Quest ROM and allows the editing of ALL 95 characters. As well as being able to design your own typefaces, fonts from other DTP packages or from Quest Pain may be loaded into the editor and converted for use with the Wapping Editor. This sophisticated editor has numerous functions including slide, flip, invert and rotate individual characters or the whole font. Individual characters can be mirrored or copied and a mask feature allows you to superimpose two characters. Lines and columns can be inserted or deleted allowing the character to be stretched or squashed. This font editor will also allow 'font' and 'brush' files to be designed for use with Quest Paint.
This package is the latest in the line of integrated professional quality mouse-driven software from Watford Electronics, the company that adds power to Beeb.

Wapping Editor	Launch Offer: **£69**
Wapping Editor with Quest Mouse	**£89**

DUMPOUT 3

A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including full Mode 7 graphics.
Also provided are window setting utilities and OSWORD calls to plot and read Mode 7 graphics pixels.

Facilities:

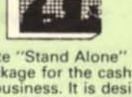
- Vertical and horizontal scaling in all graphics modes and mode 7
- Rotation of image by 90, 180 or 270 degrees
- Left hand margin setting
- Screen dump window setting
- Colours appear as grey scale
- Two tone fast dump
- Colour mask
- Mode 7 contrast expansion
- Mode 7 contiguous dump

For use with the following printers:

GLP, GP80/100/250, CANNON, STAR, KAGA/TAXAN, NEC, SHINWA CP80, GEMINI, EPSON MX/RX/FX, M1009, NEC PC8023, DMP100/200/400, Panasonic KX1081/82, Mannesman Tally and compatibles.

Only: £25

OFFICE MASTER



CASHBOOK – A complete "Stand Alone" accounting software package for the cash based sole trader/partnership business. It is designed to replace your existing cashbook system and will provide you with a computerised system complete to trail balance.

FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.

MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.

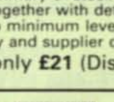
EASILEDGER – A management aid software tool designed to run alongside an existing accounting system. Essentially a Debit/Credit ledger system which can handle sales, purchase and nominal ledger routines to provide instant management information.

INVOICES & STATEMENTS – Greatly reduces the time and cost of preparing Invoices and Statements by storing essential information like customer names, addresses and account numbers. Has VAT routines and footer messages facility.

STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details of total cost, total stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21** (Disc)

OFFICE MATE



- DATABASE
- BEEBCALC SPREADSHEET
- BEEBPLOT GRAPHICS

DATABASE – Set up a computerised card index system with powerful search facilities.

SPREADSHEET – Offers many calculation and editing features.

BEEBPLOT – Provides visual representation from Spreadsheet data.

OFFICE MATE Only £10 (Disc)

Continued →

ARIES CORNER

B-32 Shadow RAM Card

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or all 32k as sideways RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Comal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus, Interword and many other applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved *FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as the printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the 6502 processor socket on your BBC micro – no flying leads to connect and no soldering. Provision of the on-board ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Price: **£80** (carr. £2)

Aries B-12 Sideways ROM Board

This board is extremely well made, simple to install, reliable when fully loaded and compatible with the Aries-B20 and the Aries-B32

The B12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on the board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

The B12 system consists of two parts: a large detachable "mother board" which carries the extension ROM sockets and a small "base board" on a short ribbon cable, which plugs into the existing sideways ROM sockets. This two-board design eliminates the reliability problems previously associated with some other ribbon-cable based systems.

If you do not have a B32 or B20, a small adaptor module (the Aries-B12C) is available at a nominal cost.

Price:	Aries B-12	£40
	Aries B-12C	£5

CREDIT CARD 24 HOUR
Ansaphone Hot Lines
(0923) 50234 or 33383

ARIES B-488 IEEE-488 INTERFACE UNIT

The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB' or 'HP-IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

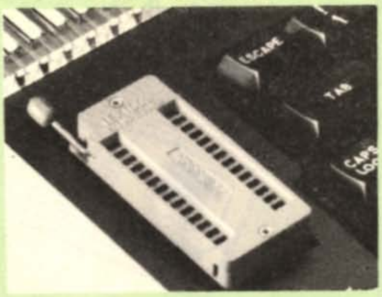
£238 (Carr £3)

EXTERNAL ROM BOARD for BBC MASTER

This external Beige finished, free standing cased unit with its own Power Supply allows you to plug-in upto 12 ROMs and 16K Sideways RAM.

Only £78

SIDEWAYS ZIF SOCKET



Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

- Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.

- The low profile of the socket allows unrestricted access to the Keyboard.

- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.

- This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for all professionals and Hobbyists alike.)

- BBC, B+ and Master compatible.

ONLY **£18** (carr £3)

Low Profile CARTRIDGE SYSTEM

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack for the BBC B.

● Complete System	£11
● Spare Cartridges	£2.50
● Spare Rack	£1.50

ROM Cartridges for the BBC Master
Twin **£8;** Quad **£12**

16K DISC RAM

(16K Sideways RAM Module)

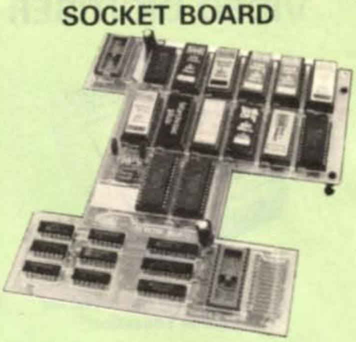
Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

- Write protection (useful in a variety of circumstances).
- Compact construction.
- Supplied complete with Battery Backup.
- No overheating or overloading problems.
- Free utilities disc supplied.
- Can be used as a 16K PRINTER BUFFER.
- Ideal for professional software development.
- Supplied with utilities software disc.

Only: **£35** (carr £2)

P.S. 16K Disc Ram Board is not designed to work in conjunction with a Sideways ROM Board.

SOLDERLESS SIDEWAYS ROM SOCKET BOARD



In the May 1986 Micro User's independent review, the writer concludes, "The board has been well laid out. Its position is much better than others – not over the HOT RAM chips and further away from the disc controller area". "I give the solderless ROM board the thumbs up and wish it success".

This brand new board from Watford Electronics is designed specifically for those wishing to add a ROM board to their own BBC without the need to perform any soldering.

This new board expands the total possible number of ROMs in a BBC from 4 to 16.

Unlike our competitors inferior boards, the ONLY upgrade required for fitting battery backup to the Watford Solderless ROM board (all Watford ROM boards, actually) is the fitting of the battery itself. (No other expensive components are required.)

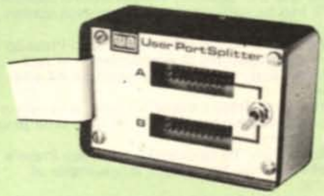
- The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:
- Increase your BBCs capacity for ROMs from 4 to 16.
- **No soldering required.**
- Very low power consumption.
- Minimal space required.
- Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
- Socket 14 takes two 6264 RAM chips.
- Read protect to make RAM "Vanish") allows recovery from ROM crashes.
- Battery backup option for RAM chips.
- Supplied ready to fit with comprehensive instructions.

Price: Only £35
Battery backup fitted **£39**
Battery Backup only **£3**
(carriage £2)

- Sideways RAM Utilities Disc for Solderless ROM Board. Includes the options to load and save ROM Images and the facility to use Sideways RAM as Printer Buffer.

Only: £8

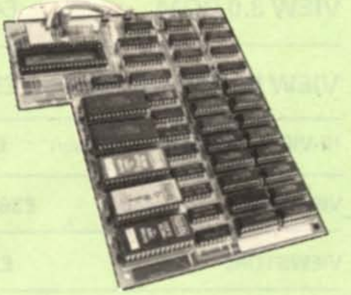
USER PORT SPLITTER UNIT



Gone are the days when you had to plug and unplug devices from the User Port. This extremely useful little device allows two units to be connected to the User Port simultaniously, and select between them simply by toggling a switch. This device is particularly useful for those people using Quest Mouse and the Watford Video Digitiser or any similar combination.

Excellent Value at **£22** (carr £2)

ROM/RAM CARD



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 3 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO overheating problems.
- No User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- Fully buffered for peace of mind.
- Firm mounting in BBC micro.
- Compatible with all BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of Battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- Accepts any ROM.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE Fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROM-SPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM-RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM-RAM Board.

The ROM-RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, for later.

Please write in for further details.

INTRODUCTORY PRICES:

● ROM/RAM card with 32k dynamic RAM	***£48***
● ROM/RAM card with 64k dynamic RAM	***£65***
● ROM/RAM card with a massive 128k dynamic RAM	**£109**

(carriage on ROM-RAM Card £3)

OPTIONAL EXTRAS:

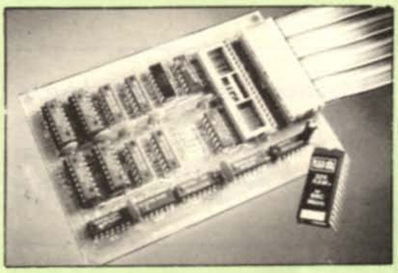
● 16k plug-in Static RAM kit	**£17**
● 16k Dynamic RAM for Upgrade	**£17.50**
● Battery backup	**£3**
● Read and Write protect switches	**£2** each
Complete ROM-RAM board All options installed	**£115**

P.S.

Is your existing ROM Board overflowing with ROMs? Do you need more Sideways RAM? Is your Board unreliable? Then upgrade to Watford ROM/RAM Board and pay £5 less

32K SHADOW RAM-Printer Buffer

Expansion Board



A MUST FOR WORD PROCESSING

Watford Electronics now brings you the latest state-of-the-art MEMORY EXPANSION BOARD for your BBC microcomputer. Don't throw away your BBC B for a BBC B Plus or BBC Master. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16K or even 20K, but a massive 32K of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer – type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.

- "VIEW" Wordprocessor users can now type in letters in 80 columns and have up to 28,000 bytes free – 5 times as much as normal.

- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24K of text in memory. This product is recommended as an ideal complement by Computer Concepts.

- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20K of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28K of program space.

- Use the FULL 32K or the bottom 12K of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS423 etc. Print large text files while running long graphics programs, and have all your buffer options available as well (*FX15,21,138,145,ADVAL etc). Please note only a 12K printer buffer can be used with Wordwise or Wordwise-Plus, due to the way they are written.

- Unique facility to turn ROMs off and on again. Unlike all other ROM managers, this feature does not use 'unofficial' memory. Two bytes of normally user-inaccessible memory on the RAM card are used to ensure ROMs are disabled WHERE OTHER ROMS FAIL.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Only £59 (carr £2)

(Price includes a comprehensive manual and the ROM)

INCREDIBLE WORDPROCESSING DEAL

Watford's 32K SHADOW RAM CARD and Computer Concept's INTERWORD Wordprocessor package.

at Only **£89** (carr £2)

BBC SOFTWARE'S Popular Educational Software

● Maths with a Story 1 (Disc). 4 primary level maths programs	**£11.25**
● Maths with a Story 2 (Disc) 4 further maths programs	**£11.25**
● Picture Craft (Disc) 6 - 14 age group. Pack consists of flexible geometrical design & colouring programs	**£17**
● WAVES: Science Topics (Disc) CSC O Level Physics program.	**£14.95**
● RELATIONSHIP: Science (Disc) O Level Biology program.	**£20.00**
● BONDING: Science (Disc) O Level Chemistry program.	**£20.00**
● ELECTROMAGNETIC SPECTRUM (8 Discs) O Level program.	**£20.00**
● ELECTRONICS IN ACTION (Disc) O Level program	**£19.95**
● NEWTON & THE SPACE SHUTTLE (Disc) O Level program.	**£20**
● ECOLOGY (Disc) O Level program.	**£20**
● POLYMERS (Disc) O Level program.	**£20**
● Clasification & Periodic Table O Level. The suite is supplied with its own database of chemical elements which can be classified according to your own rule.	**£20**
● FOOD & POPULATION (Disc) O Level program.	**£20**
● MICROTECHNOLOGY (Cassette) O Level program.	**£11.25**
● A VOUS LA FRANCE (2 Cassettes) A French language home study aid.	**£21.70**
● DEUTSCH DIREKT! (Disc & Audio Cassette)	**£19.95**
● Modem Master (Disc)	**£11.25**
● ADVANCED TELETEXT SYSTEM	**£8.65**
● PERIOD TABLE SOFTWARE	**£20**
● Astronomy – Primary (Disc)	**£12**
● Computers at Work – Primary	**£17.35**
● Introducing Geography – Primary	**£17**
● **Introducing Geography 11-17yrs**	**£17.50**
● Electric Fields 6-14 years	**£11.25**
● BlackQueen Contract Bridge	**£13**
● Espana Viva – 3 Discs	**£19.95**
● A Vous La France Disc	**£21.50**

Acorn's Speech Synthesiser package, complete
Special Cffer £15
BBC B Micro only

Versatile **BEEB SPEECH SYNTHESISER** Unit

Beeb Speech Synthesiser

The Watford Speech Synthesiser is a very flexible speech synthesis unit based upon the powerful phonemes system. This system stores the building blocks of speech (called phonemes) and allows you to combine them quickly and easily to form virtually any word imaginable.

Supplied with an advanced ROM, you are provided with a 500 word dictionary to get you started. These can easily be added to by following the notes given in the comprehensive manual.

SPECIAL PRICE £32 (carr £2)

Continued →

COMPUTER CONCEPT'S ROMS

ACCELERATOR	£30
CARETAKER Basic Utility	£23
DISC DOCTOR	£28
Graphics ROM	£29
TERMI	£25
COMMUNICATOR	£49
Printmaster	£24

Wordwise £26

Wordwise plus £40

We are giving away absolutely **FREE,** the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
- Chapter marker.
- Epson printer codes function key option.
- Search and display in preview mode.
- Embedded command removal.
- Print Multiple copies of a document.
- Multiple file options for print and preview.
- Address finder.
- Label printer.
- Mail-merger.
- Number/delete/renumber.
- Clear text-segment area.
- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc Interface in your Micro)

HI-WORDWISE-PLUS DISC: £5

SPELL MASTER **£42**

Inter SHEET ONLY £37

INTER CHART ONLY: £25

Inter-WORD **£36**

MEGA-3 ROM

Interword, Intersheet & Interchart – 3 in one ROM £76

INTERBASE £49

All Prices Exclusive of VAT

MINI OFFICE II

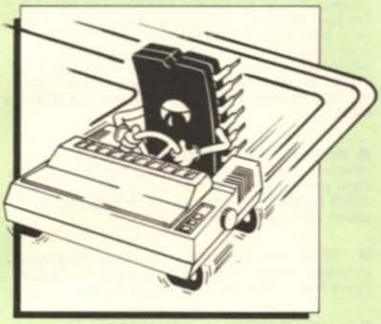
DISC Version for BBC B & B+	£14.00
DISC Version for BBC Master	£16.50
Disc Version for the Compact	£18.00

(When ordering please specify for which Micro & 40 or 80 track Disc).

Advanced Computer Products

Advanced Disc Toolkit	£30
Advanced Disc Investigator	£25
Advanced 1770 DFS BBC	£29
Advanced 1770 DFS Master	£30
Advanced File Manager	£25.00
Advanced Control Panel	£30.00

VIEW PRINTER DRIVER ROM



View is a powerful word processor, but until now has seriously lacked in terms of printer support. With the launch of our Printer Driver ROM, which includes an extremely powerful and easy to use Printer Driver Generator, View users can find themselves in the realms of advanced word processing only at a small outlay.

The VPD extends View's printer command with a series of mnemonic commands. All standard highlight sequences are also supported. A large range of printers are supported by drivers contained within the ROM (the drivers can be downloaded and customised). Printers supported include: Epson's MX, RX, FX, FX, LX, JX80 range, HI80, KP810/910, PW1080, JP101, HR15, M1009, GLP, Panasonic KX-P1081/2, JUKI 6100, etc.

Other printers are readily supported by defining a Printer Driver using the built in Printer Driver Generator. The features mentioned below are available to both the built in Printer Drivers and user defined drivers (assuming the printer supports the features).

NLQ control, Underline, Bold, Proportional Spacing, Microspacing, Italic, Superscript, Subscript, Condensed, Enlarged, Double Strike, Set lines per inch numerically (e.g. LPI 6), Set characters per inch numerically (e.g. CPI 5), Select printer font, Select printer ribbon colour, Translation sequences, Emulation of BBC Character Set, Simple numeric expressions for certain operations, Full printer setup, Send control codes, Print prompt on screen, Redefinable Pad character, Pause for key press, Prompt to change daisywheel, and Execute * command when printing.

Other features include a very powerful on screen preview, with bold, italic, underline, super/subscript, enlarged highlights, and a special printer driver to allow memory based text to be previewed by View 1.4. Of course, View 1.4, 2.1 and 3.0 are all supported, as is Shadow RAM and 6502 Second Processors. The BBC B series and Master series of micros are supported. A comprehensive manual is supplied. All in all, a very professional product for the discerning user who wants power at their finger tips. (Write in for a detailed leaflet).

Price: Only £33

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- Terminal Emulator & Editor
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A worth-while addition to any Master owner's library.

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It is possible to gain a full understanding of the mouse from this manual. For those not interested in exactly how the mouse functions, complete example programs are also included. These may be typed directly into the micro, without the need for any understanding of the hardware or software involved, enabling the mouse to be used for custom applications.

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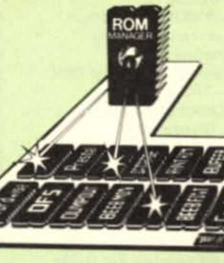

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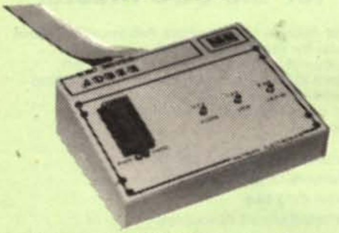

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- Automatic disc buffering to allow programming of 32K 27256 devices from a 32K file without extra effort.
- Verification gives detailed error list and checksums are maintained. There is also a blank check facility.
- Works with all standard filing systems. Generates header code for RFS ROMs to allow Basic programs etc. to be stored in EPROM. More than one file per ROM permitted.
- Programs the following EPROMs: From 2K to 32K: 2516, 2716, 2532, 2732, 2764, 2764A, 27128, 27128A, 27256 (Both 12.5V and 21V).

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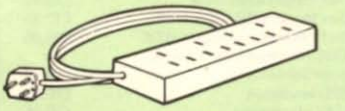

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- 8087-2 maths co-processor, optional.
- 640K minimum expandable to 1024K on system board, extra 384K RAMDISK available.
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- CLOCK on System board, gives non stop DATE & TIME.
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- 102 keys keyboard.
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- Optional 80287 Maths co-processor
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Integrated package of software and cabling to use cassette recorder as file storage for the Z88. Includes catalogue tape, Save,Fetch and Verify. Also option to run machine program from FAM. Z-Tape menu follows the pattern of []F, Filer. **£52.50**

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Z88 Real Power Computing	F.R. Flaig	£12.00
Z88 Reference Manual	M-Tec	£16.00
Z88 Software Developers Guide	Cambridge Comp.	£35.00
Using your Z88	Patrick Hall	£10.00

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Product: Z-Tape
Price: £49.99
Supplier: Wordmongers, 21 Edison Road, Rabans Lane, Aylesbury HP19 3JE.
Tel: 0296 437878

A sort of streamer

John Allen evaluates a new way to save files from the portable micro

WORDMONGERS is fast getting a reputation as *the* major supporter of the Z88. The company has produced a communications package called Z-Term, a database – zBase – and now an archiving system, Z-Tape, along with a couple of games on the side. Z-Tape is a delightfully simple idea. It links the Z88's serial port to a cassette recorder in order to keep backup copies of files.

At first it seems a retrograde move when you are used to the BBC Micro's discs, but it's a real step forward for the portable.

Normally Z88 files are kept permanently on eprom cartridges, but byte for byte this costs anything up to 200 times as much as saving to disc, which is why backup links are so popular – you can transfer files to the BBC Micro and then save them.

The Z-Tape software comes on a rom cartridge plus a connection lead. It's not necessary to have a special machine – most recorders will do. The general rule is that the cheaper and simpler the machine the better.

Unlike the cassette system on the BBC Micro Z-Tape saves a number of files as a single chunk together with an initial block of catalogue information about them, so it is more akin to a tape streamer than a straightforward file saver. In other respects it is similar to the eprom system, transferring tape files to and from ram memory. Files cannot be accessed directly by Z88 software.

Once installed, the rom is selected by ◊J and the screen looks remarkably similar to that of the Filer. There is a list of commands on the left and the files in the default directory are displayed in a large central window. Commands, selected by moving the cursor highlight bar or by □ sequences, allow saving, looking at the catalogue, verifying tape files – almost essential to check that they have saved correctly – and fetching. Additionally you can select different directories and devices and there's an option to load a machine code file into memory and run it.

I found that saving to tape was easy, but only being able to save from a single directory on one device at a time is unnecessarily restrictive, as the main use surely is to backup everything on the whole machine. That aside, it is possible to mark a number of files in the displayed directory – using Tab – or to use the normal * and ? wildcards within filenames.

A very clear display shows exactly what is happening while the process is going on and, usefully, the software calculates how big a cassette is required for the operation to be a success. Inevitably the saving is slow, but not unbearably so.

Fetching files from tape is a different proposition, however. As with all tape systems, you have to fiddle about with the cassette recorder volume control and in my case I found it impossible to use with three different machines. I discovered this was because the machine I was to using to record on was doing so out of phase, so I had to alter the lead.

Apparently this is likely to be a problem in around 10 per cent of machines. Z-Tape works by looking for rising pulses, and if the phase is wrong you get falling pulses which are not good enough.

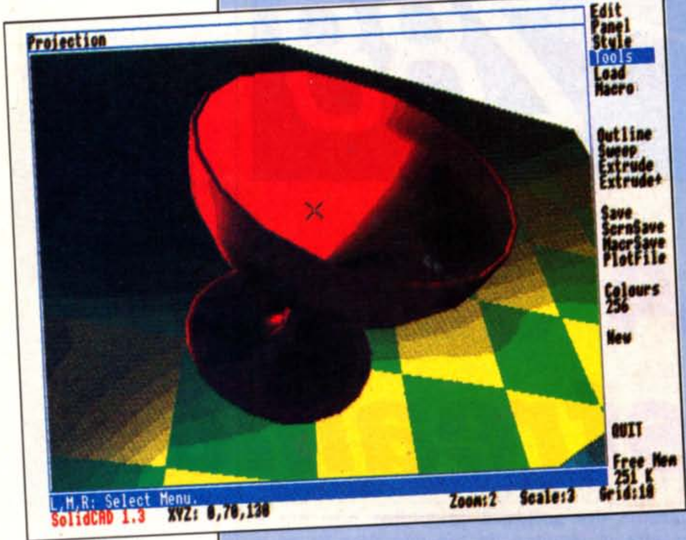
If you hit this problem try changing the signal and the screen lines around in either the record or playback plug. After this modification note that both plugs should not be put into the cassette machine at the same time. Unfortunately the notes which explain the technicalities of how Z-Tape works, which would have helped me to realise that there was a phase problem, are supplied on a cassette which I was unable to load because of the problem. Catch 22.

Once I had sorted out the volume and phase I found that it fetched files reliably. Z-Tape has options to fetch a particular file, all those on a tape or the next one. In each case the file or files will be stored in the currently selected device and directory, overwriting – without warning – like-named files, so it might be best to fetch into a new directory.

My only real reservation about this product is its inability to save from more than one directory at a time.

Summing up

I'm sure this product will help to sell a Z88 to people who do not already own a micro, as for them it is a far cheaper way of backing up files than using eproms. If you have another machine like a BBC Micro, I would stick to backing up on disc.


Projection
Edit
Panel
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Tools
Load
Macro
Outline
Sweep
Extrude
Extrude+
Save
ScrnSave
MacrSave
PlotFile
Colours
256
New
QUIT
Free Mem
251 K
L,M,R: Select Menu.
SolidCAD 1.3
XYZ: 0,70,130
Zoom:2
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Grid:10

The package's demonstration goblet

Really solid design

Steve Bruntlett examines the potential of 3D CAD

Product: Realtime Solids Modeller (includes SolidCAD & Realtime Graphics Language)
Price: £89.95 (SolidCAD only £49.95)
Supplier: Silicon Vision Ltd, Signal House, Lyon Road, Harrow, Middlesex HA1 2AG
Tel: 01 422 2274

THREE dimensional design work is one of the expanding areas in the Archimedes market because of the machine's speed – allowing fast and effective rendering of complicated scenes – and the variety of high resolution, colour screen modes available. Realtime Solids Modeller – which exploits these advantages – consists of a single disc and a comprehensive manual with several excellent tutorials covering the construction of a cube and pyramid, zooming and panning, swept and extruded surfaces, macro operations, the tools option, camera perspective and smooth shading.

When booted up the program sets the configuration of the Archimedes and puts up a screen with four windows, or viewports, as Silicon Vision likes to call them, which show the plan, projection, front and side elevations of the scene being constructed. Figure I shows one supplied in third angle projection.

The first angle projection system, which was used in engineering drawing a few years back, is also catered for. Any of the viewports can be enlarged to full screen size at any time by clicking Adjust over the window.

There is a command line below the four viewports and a second line below that giving the X,Y,Z coordinates of the working position with Zoom, Scale and Grid steps which can be set to your own requirements.

A menu down the right hand side shows

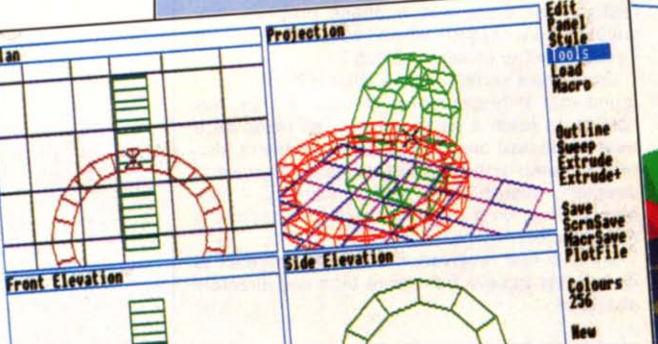
Plan
Projection
Front Elevation
Side Elevation
Edit
Panel
Style
Tools
Load
Macro
Outline
Sweep
Extrude
Extrude+
Save
ScrnSave
MacrSave
PlotFile
Colours
256
New
QUIT
Free Mem
409 K
L,M,R: Select Menu.
SolidCAD 1.3
XYZ: 270,0,-160
Zoom:1
Scale:1
Grid:10

Figure I: A supplied third angle projection

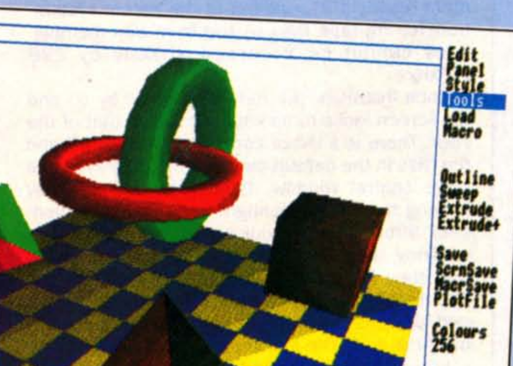
Edit
Panel
Style
Tools
Load
Macro
Outline
Sweep
Extrude
Extrude+
Save
ScrnSave
MacrSave
PlotFile
Colours
256
New
QUIT
Free Mem
279 K
270,0,-190
Zoom:1
Scale:1
Grid:10

Figure II: The manipulated image

memory free and offers Edit, Panel, Style, Load and Macro menus. The option to quit resets your standard configuration.

The package has several interesting demonstration images of goblets, eggs, interlocking rings and geometric solids. The Panel menu is used to manipulate the current image controlling the camera and light source positions and also the size, position and orientation in space of the current object. The viewing position can also be changed to give wide angle or telephoto effects.

Working with the mouse to draw and select options works very well in practice, and reference to the manual is only needed for finer points.

Once the image is the right shape, size and position with the desired amount of direct and ambient lighting, it can be viewed at full screen size by clicking Adjust. At this, or any other stage, the scene or object can be saved as a SolidCAD file, a full screen file for use with an art package or as a Plotfile for driving a plotter or high resolution dot matrix dump program such as SuperDump, which is also produced by Silicon Vision.

Figure II shows the manipulated image with shading selected from the Style menu. This is the most complex menu to get to grips with and allows you to change the on-screen image from wireframe to hidden surface removal. There are also options for shading concave and convex objects – the one used in Figure II is the standard Shade option. This gives smooth shading and a very realistic appearance to the objects in the scene.

The manual recommends that you use the Scan option until you understand what effects the others achieve.

Pictures can be dumped directly to Epson FX, MX and RX compatible printers or to an Integrex in colour or monochrome. The pictures illustrating this review were produced using the 256 colour mode. Sixteen colours can be used for realisation of images but is really only suitable for wireframe or monochrome-shaded scenes.

Figures III and IV show a house developed through the Edit menu. The system works very well, with flat surfaces being drawn easily in the plan, front and side elevation viewports. Sloping planes are a bit more complicated as you have to swap between two of the viewports as you go.

The object is shown in the Projection viewport as it is constructed. If you run out of space using the window scroll bars uncovers more work area.

Using the Outline, Sweep and Extrude options of the Tools menu is very straightforward. To produce a 3D object such as a bottle, all you have to do is draw an outline profile, specify the central axis and click Menu and the micro does the rest, producing the object in the Projection window in wireframe or shaded form depending on the currently selected Style option.

Extruded shapes are also very easy: Draw the outline as before, select Extrude, position the direction and length with the mouse and the object is automatically produced. The steps of the Sweep and Extrude option can be set smaller if you want smoother curves.

Realtime Solids Modeller is available on its own or with the Silicon Vision Realtime Graphics Language which allows you to animate objects from Basic or other languages. If you're looking for a 3D CAD package this is certainly worth a try.

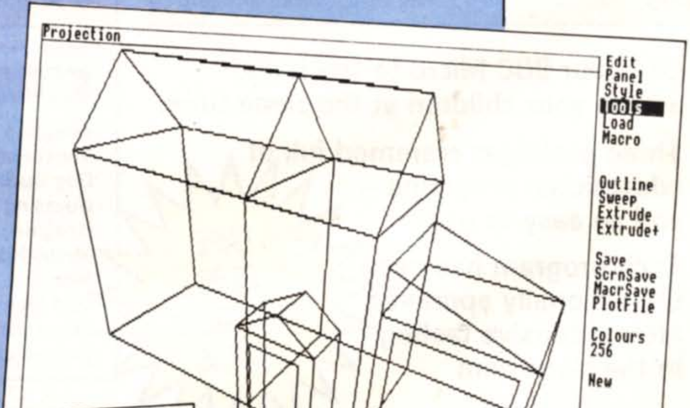

Figure IV: The third angle house

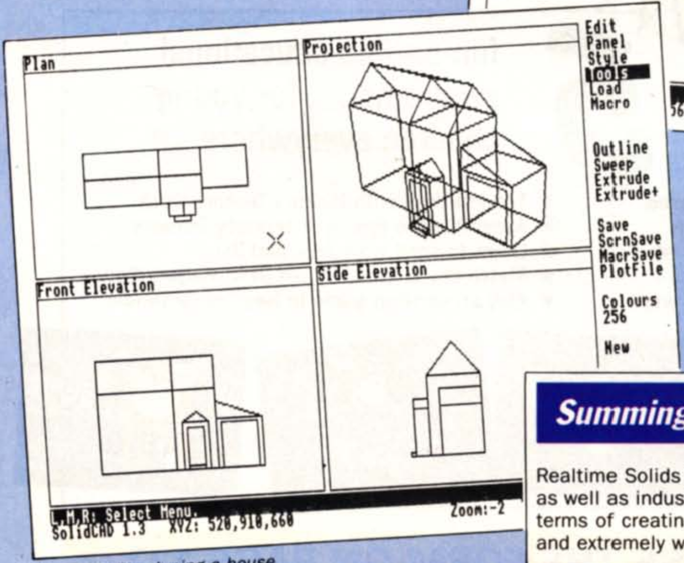

Figure III: Developing a house

Summing up

Realtime Solids Modeller should have many applications in schools as well as industry, and even at home it has a great deal to offer in terms of creating images purely for pleasure. It is very easy to use and extremely well documented if you get stuck.

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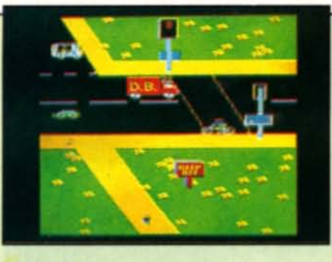

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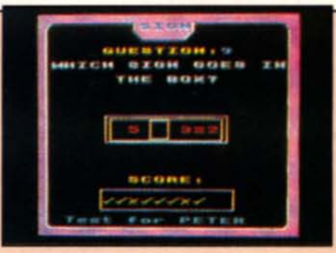

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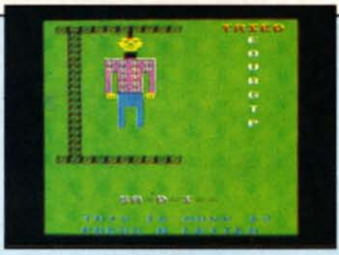

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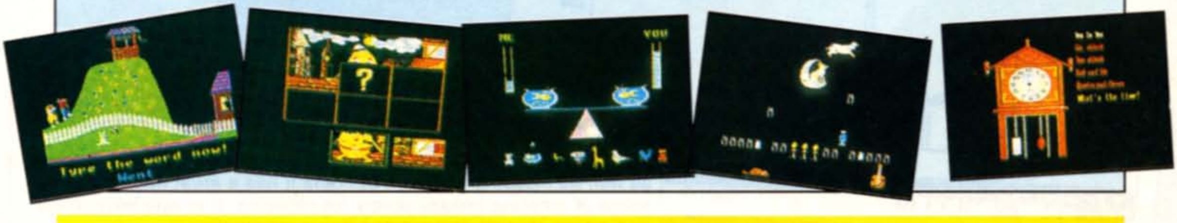


TO ORDER PLEASE USE THE FORM ON PAGE 127

Triple entry book-keeping

Three accounts packages compared by Jon Revis

Product: Account Book
Price: £27.95
Supplier: Apricote Studios, 2 Purls Bridge Farm, Manea, Cambridge PE15 0ND.
Tel: 035 478 432

Product: Taxman
Price: £58.13
Supplier: Micro Aid, Kildonan Courtyard, Barrhill, South Aryshire KA26 0PS.
Tel: 0465 82288

Product: Money-Wise
Price: £59.95
Supplier: Derbyshire Software, 70 Lees Hall Avenue, Sheffield S8 9JF.
Tel: 0742 557229

HOW many times have you considered delving into the mysterious world of accountancy and doing it yourself? Why shouldn't you? You're intelligent, you've got a grand's worth of computer equipment lying idle, so why not take a shot at increasing your profits by cutting out the middle man? By reducing the length of time your accountant has to spend on your books he should have no defence when you suggest that there be a corresponding reduction in his fees.

This month we take a look at three packages designed to take the hassle out of DIY accountancy – The Account Book from Apricote Studios, Money-Wise from Derbyshire Software and Taxman from Micro Aid.

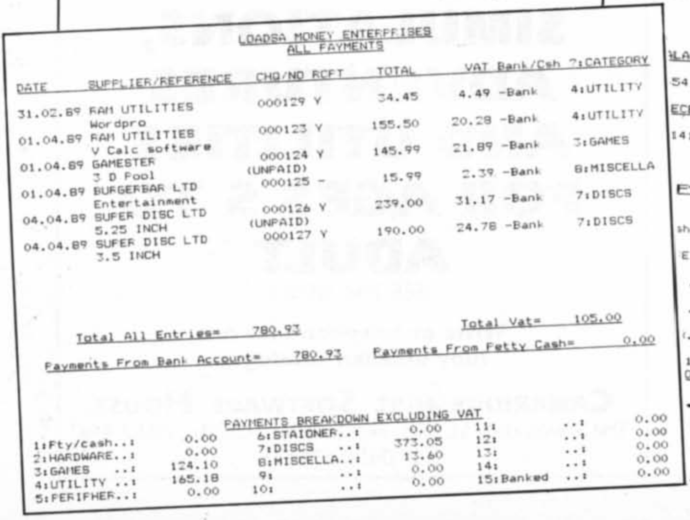
The Account Book is supplied on a single 80 track disc and requires a minimum of a BBC B and a single 80 track double sided disc drive. I was pleased to see that Apricote has faith in the honesty of its customers and provides precise details on how to create a working copy.

Using a system known as double entry book-keeping, all monies received are first entered into the Receipts book as work done: Once the money has been paid into the bank it can then be entered into the Payments book under the heading banked.

A series of menus provide access to all areas. They are displayed using the teletext colour of Mode 7, with the program changing to 80 column mode for the serious business of data entry.

Job number one, when first using it, is to set up a series of accounts for your regular customer and suppliers. This list can be added to at any time so don't worry if you forget anything. Not only do these headings allow you to look at certain customers in isolation, they also provide a means of speeding up data entry when using the

Turn to Page 113 ▶



```
                       LOADSA MONEY ENTERPRISES
                             ALL PAYMENTS
                                                     VAT Bank/Csh ?:CATEGORY
DATE      SUPPLIER/REFERENCE    CHQ/NO RCPT   TOTAL
                                                      4.49 -Bank   4:UTILITY
31.02.89 RAM UTILITIES            000129 Y     34.45
         Wordpro                                     20.28 -Bank   4:UTILITY
01.04.89 RAM UTILITIES            000123 Y    155.50
         V Calc software                             21.89 -Bank   3:GAMES
01.04.89 GAMESTER                 000124 Y    145.99
         3 D Pool               (UNPAID)              2.39 -Bank   8:MISCELLA
01.04.89 BURGERBAR LTD            000125 -     15.99
         Entertainment                               31.17 -Bank   7:DISCS
04.04.89 SUPER DISC LTD           000126 Y    239.00
         5.25 INCH              (UNPAID)             24.78 -Bank   7:DISCS
04.04.89 SUPER DISC LTD           000127 Y    190.00
         3.5 INCH



                                                  Total Vat=    105.00
     Total All Entries=    780.93
                                              Payments From Petty Cash=     0.00
  Payments From Bank Account=    780.93


                    PAYMENTS BREAKDOWN EXCLUDING VAT                        0.00
                           6:STAIONER..:       0.00   11:           ..:    0.00
1:Fty/cash..:     0.00     7:DISCS    ..:    373.05   12:           ..:    0.00
2:HARDWARE..:     0.00     8:MISCELLA..:      13.60   13:           ..:    0.00
3:GAMES   ..:   124.10     9:          ..:     0.00   14:           ..:    0.00
4:UTILITY ..:   165.18     10:         ..:     0.00   15:Banked     ..:    0.00
5:PERIPHER..:     0.00
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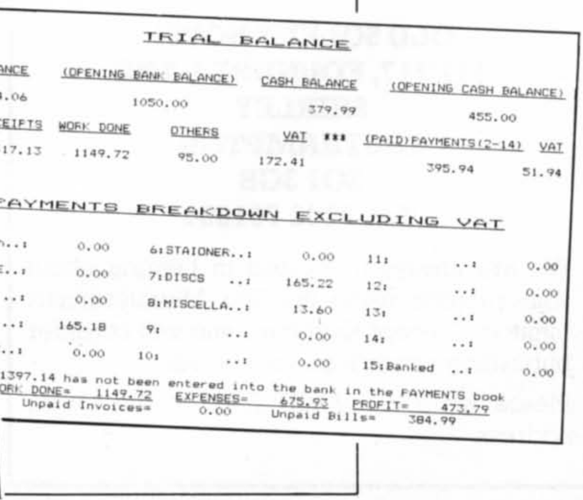

```
                          TRIAL BALANCE

LANCE   (OPENING BANK BALANCE)   CASH BALANCE    (OPENING CASH BALANCE)
54.06           1050.00
                                      379.99
                                                         455.00
ECEIPTS  WORK DONE     OTHERS          VAT  ***  (PAID)PAYMENTS(2-14)  VAT
1417.13   1149.72       95.00     172.41
                                                         395.94        51.94

PAYMENTS  BREAKDOWN  EXCLUDING  VAT

sh..:       0.00    6:STAIONER..:      0.00   11:               ..:    0.00
E..:        0.00    7:DISCS    ..:   165.22   12:               ..:    0.00
 ..:        0.00    8:MISCELLA..:     13.60   13:               ..:    0.00
 ..:      165.18    9:           ..:   0.00   14:               ..:    0.00
(..:        0.00    10:          ..:   0.00   15:Banked     ..:        0.00
1397.14 has not been entered into the bank in the PAYMENTS book
ORK DONE=   1149.72   EXPENSES=     675.93   PROFIT=     473.79
   Unpaid Invoices=          0.00     Unpaid Bills=    384.99
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◀ *From Page 111*

Receipts or the Payments books.

A complete list of headings is displayed at the bottom of the screen, and when the program prompts for a customer name you have the option of pressing a single key to select one of the 20 available. Alternatively you can still type the account name manually.

Looking at the Receipts book, after entry of customer names we have a field for an invoice number – most important when wanting to trace transactions in relation to a customer query. VAT can be dealt with in a variety of ways. It can be ignored in the case of zero rated items, it can be calculated manually if the VAT is not at the standard rate, or you can simply press V to invoke the auto VAT feature.

In the last instance you are prompted for the total cost including VAT, from which the program will calculate the amount payable and the total excluding VAT. Each entry of the Receipts book has space for a short comment to be appended and a final field noting whether or not payment has yet been received.

Updates

The Payments book is similar in appearance to the Receipts book except that invoice has been replaced by cheque number and there is an additional field to indicate whether payment was drawn from the bank or from petty cash.

Complete or partial lists of receipts and payments can be called up at any time. Those to be selected can be indicated by date, customer name, a specific entry in the comment field, paid, unpaid or cash payments, to name but a few.

All transactions that match the selection criteria can be displayed on screen or directed to the printer along with a total for the entries concerned, the amount of VAT payable and whether the money for payments came from the bank or petty cash.

The data disc is updated following every entry, while the remaining disc capacity is indicated as a number of entries. One side of an 80 track disc is capable of storing approximately 1,200 receipt entries and a similar number of payment book details.

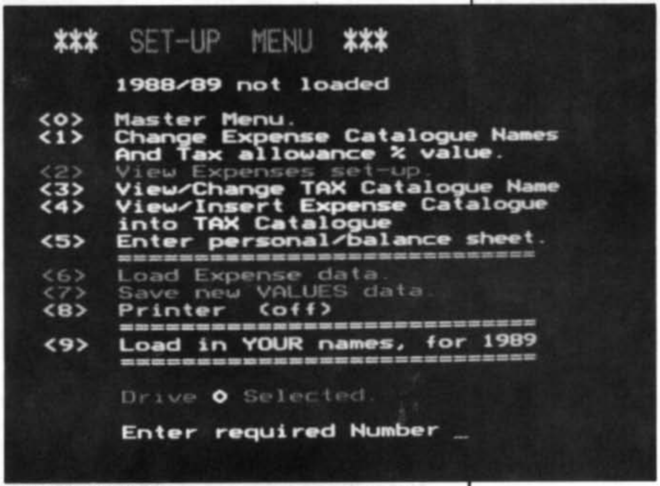
A Results menu allows you to perform a trial balance, which highlights any anomalies on your accounts and allows you to investigate them before printing out your finalised Receipts or Payments books. The two books provide a continuous summary of your financial health, with suitable sub-totals for each month. Those who prefer it can request a Profit/Loss graph for the last three months' trading.

I was very impressed with The Account Book, my only grumble being the lack of an option to use operating system star commands from within the program and some concern that the reporting system may prove to be slow when working with a full data disc.

Package number two, Money-Wise, is a very different beast. It is supplied on rom or as a rom image suitable for loading into sideways ram. The review copy showed a great reluctance to load into ram, so I assessed a main memory demo version. Unlike The Account Book, where every transaction is written directly to disc, Money-Wise stores the complete data file in memory, only accessing the drive when you re-save the file at the end of a book-keeping session.

My initial thoughts were that this set-up would severely restrict the total number of transactions that could be handled by the package. However, I am assured that a 32k BBC Micro can store more than 3,000 entries.

The ram-based system gives Money-Wise a tremendous speed advantage over the previous product and this is most apparent when the system is called on to calculate a trial balance or a period report. The editing of existing transactions is another area that benefits from the accessibility of ram. Using the up and down arrows you can scroll in either direction through a customer's account, editing entries, and always seeing an up to date display of the debit and credit totals at the bottom of the screen.



```
  ***  SET-UP  MENU  ***

       1988/89 not loaded

<0>    Master Menu.
<1>    Change Expense Catalogue Names
       And Tax allowance % value.
<2>    View Expenses set-up.
<3>    View/Change TAX Catalogue Name
<4>    View/Insert Expense Catalogue
       into TAX Catalogue
<5>    Enter personal/balance sheet.
       ==============================
<6>    Load Expense data.
<7>    Save new VALUES data.
<8>    Printer  (off)
       ==============================
<9>    Load in YOUR names, for 1989
       ==============================

       Drive 0 Selected.

       Enter required Number _
```

Using Money-Wise

Since we don't live in a perfect world, it is not unreasonable to expect that the ram-based system must also have its negative points. In order to provide users with the maximum possible space for data storage the program operates using Mode 7.

Each transaction entry is limited to a single line on the screen, presumably to make the bi-directional scrolling and totalling routine less complicated.

With only 40 columns to play with, the details of each transaction have had to be restricted to the bare essentials of a date, account name and an entry in either the credit or debit columns.

Now call me old-fashioned if you like, but I far prefer the Account Book system whereby I can enter details relating to invoice and cheque numbers and even a comment of some description.

The procedure for setting up the system is very similar to that of Account Book – you enter a list of account names of which there were more than 100 on the demo system.

All debit and credit entries can be made via the Accounts Screen. Pressing one on the main menu prompts a request for the account name; this need not be input in full since the program makes

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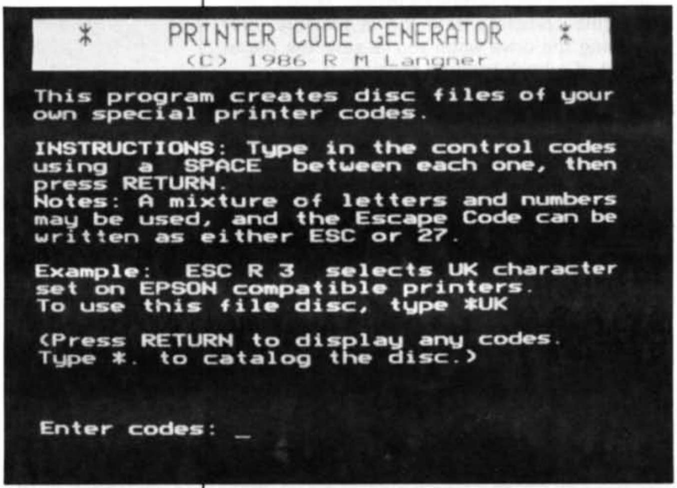

```
*       PRINTER CODE GENERATOR       *
          (C) 1986 R M Langner

This program creates disc files of your
own special printer codes.

INSTRUCTIONS: Type in the control codes
using  a  SPACE  between each one, then
press RETURN.
Notes: A mixture of letters and numbers
may be used, and the Escape Code can be
written as either ESC or 27.

Example:  ESC R 3  selects UK character
set on EPSON compatible printers.
To use this file disc, type *UK

(Press RETURN to display any codes.
Type *. to catalog the disc.)


Enter codes: _
```

Preparing personalised printer codes

◀ **From Page 113**

a guess at which account you are seeking with every successive letter you type.

Pressing Return calls up the selected account displaying all previous transactions, and here you can add new data or edit existing entries.

Towards the bottom of the screen is a small information window displaying the current balance of any two accounts of your choice; cash and bank current account tend to be a pretty good combination. If the account you are editing debits or credits either of these accounts the balance affected is updated instantly.

Money-Wise's treatment of VAT has both good and bad points. When it comes to calculating your returns for the month you need only give it two dates and press V on the main menu, and hey presto, you are presented with all relevant figures and their corresponding box numbers on the VAT form.

Getting the VAT amounts into the machine in the first place is a bit of a nuisance.

For each transaction in an account that has VAT associated with it you must enter a second titled VAT immediately beneath the first and type the amount payable at this point

The calculation of this is your responsibility. This is apparently so that you can cope with zero rated items and those at which VAT may be payable at a different rate to the standard 15 per cent. So how come The Account Book can cope with such entries and provide the labour-saving auto-VAT feature?

Money-Wise is fast, convenient and easy to use, however its transaction details are sparse – you need a calculator for your VAT entries and it costs more than twice as much as The Accounts Book.

The final member of this taxing trio is Taxman from Micro Aid, a program that is, according to the documentation, *designed to handle your weekly expenses and income and then provide a printout at the year end. The report contains everything that the tax man requires and can therefore be passed to him directly, thereby eliminating your accountant.*

Documentation is provided as a four page text file on the disc. I found this to be inadequate for a program of this type. Taxman is not only the least user-friendly package of the three reviewed it also requires more than a passing knowledge of the workings of the tax system.

Source of irritation

As with the previous programs, you must first spend some time setting up the system, tailoring it to your requirements.

Stage one of this procedure involves producing a list of expense catalogues. Since the program already holds a list of 39 headings such as wages, telephone and petrol, there should be little need to change. Each has a percentage figure associated with it and this is the proportion of that expense category that can be offset against tax.

Another important part of the set-up process is the inputting of your personal balance sheet – four screens of financial questions relating to tax allowances, National Insurance contribution limits, balance sheet details from the previous year and opening and closing stock levels. Once established, these details can be saved to disc.

One constant source of irritation when using Taxman with a single drive system were the disc swapping prompts: Having been asked to insert the data disc and then press a key you are then required to tell the program which drive the disc is in – every time. Why can't the program assume that you are going to use your previous selection unless you inform it otherwise?

Having negotiated the set-up procedure I moved on to the Expenses menu. Before I had even entered a single transaction the capacity indicator stated that the system was capable of storing a maximum of only 400 entries. This would appear to be rather measly when compared to the 2,500 to 3,000 of the previous products.

It was while attempting to make an expense entry that I began to suspect that the program had been written by Micro Aid's tea lady. Each entry requires a date, an item description, an amount and an expense category in which it should be recorded. Simple.

Don't you believe it, I spent 10 minutes trying to enter an expense category name before realising that my efforts were being rejected because I was typing in lower case. Spurred on with renewed enthusiasm I found that the date field would happily accept the word SANDWICH as a valid entry.

Similar amateurish routines were rife throughout the rest of the program. This is one package with which I would certainly not entrust the safekeeping of my business accounts.

Summing up

The Account Book gets first prize for both price and performance. It is easy to use and the auto VAT option is very useful. Money-Wise was a close second, and if the price came down it would only lose by a short head – the speed is a real boon while only the use of Mode 7 and the manual VAT entry hold it back. Taxman earned a very deserving last place.

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```
3,140,128,254,255,255,254,224,224,224
  150 VDU23,141,28,127,227,193,192,0,0,0
,23,142,224,224,224,224,224,224,224,224,
23,144,24,60,126,159,143,135,70,60
  160 VDU23,147,4,64,0,137,0,33,0,9,23,1
48,49,186,110,38,165,75,102,36,23,149,0,
0,63,127,255,223,207,207
  170 VDU23,150,0,0,252,254,255,255,255,
255,23,151,199,199,195,193,192,192,127,6
3,23,152,255,255,255,255,63,15,254,252
  180 VDU23,143,129,129,255,129,129,129,
255,129,23,155,0,0,0,0,0,0,3,15,23,156,8
,33,4,32,68,64,192,240
  190 VDU23,153,12,29,28,29,28,15,3,0,23
,154,112,184,56,184,120,240,192,0,23,157
,40,1,84,0,37,64,192,224
  200 VDU21
  210 IF PAGE<&E01 THEN 250
  220 *K.0 *T.|MF.A%=0TO(TOP-PA.)S.4:A%!
&E00=A%!PA.:N.|MPA.=&E00|MO.|MDEL.0,240|
MVDU6|MRUN|M
  230 *FX138,0,128
  240 END
  250 ON ERROR GOTO 3260
  260 VDU6:MODE 129
  270 PROCinit
  280 PROCtitle
  290 REPEAT
  300 PROCsetup
  310 PROCfactory
  320 REPEAT
  330 PROCfred
  340 PROCdripfall
  350 B%=B%+1
  360 IF B%>F% PROCfire
  370 C%=C%+1:PROCbombs
  380 IFC%=2 C%=-1
  390 UNTIL T%=0 OR temp%=100
  400 IF T%=0 PROCcongrats
  410 IF sc%=5:PROCfinished
  420 IF temp%=100 PROCdie
  430 UNTIL FALSE
  440 DEF PROCfred
  450 IF INKEY-17 THEN *FX210,1
  460 IF INKEY-82 THEN *FX210,0
  470 VDU31,X%,Y%+4:CALL&80
  480 IF ?&70=32 PROCw:Y%=Y%+1:PROCprint
fred:ENDPROC
  490 IF ?&70+UP%=143 SOUND2,3,99,1:UP%=
Y%+3
  500 IF UP%>0 PROCup:GOTO540
  510 IF INKEY-67IF X%<39 PROCright
  520 IF INKEY-98IF X%>0 PROCleft
  530 IF INKEY-74 IF L%>0 PROCtipbucket
  540 IF X%+Y%=61 PROCprintfred
  550 IF X%=F%(0) IF Y%-H%(0)>-5 IF Y%-H
%(0)<2 temp%=100
  560 IF X%=F%(1) IF Y%-H%(1)>-5 IF Y%-H
%(1)<2 temp%=100
  570 IF X%=F%(2) IF Y%-H%(2)>-5 IF Y%-H
%(2)<2 temp%=100
  580 ENDPROC
  590 DEF PROCright
  600 SOUND1,1,0,1:PROCw
  610 VDU31,X%+1,Y%+3:CALL&80
  620 IF ?&70<>32 PROCcheck
  630 X%=X%+1:U%=1:PROCprintfred
  640 ENDPROC
  650 DEFPROCprintfred
  660 Z%=Z%+1:IF Z%=2 Z%=0
  670 VDU31,X%,Y%,17,1,138,10,8
  680 I%=Z%*2:COLOUR2
  690 IF U%=1 VDU128,10,8,129+I%,10,8,13
0+I%
  700 IF U%=-1 VDU133,10,8,134+I%,10,8,1
35+I%
  710 ENDPROC
  720 DEF PROCleft
  730 SOUND1,1,0,1:PROCw
  740 VDU31,X%-1,Y%+3:CALL&80
  750 IF ?&70<>32 PROCcheck
  760 X%=X%-1:U%=-1:PROCprintfred
  770 ENDPROC
  780 DEF PROCcheck
  790 IF ?&70=144 SOUND2,1,99,2:L%=L%+1:
```

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```
PROCupdate
  800 IF ?&70=128 SOUND2,2,0,1:li%=li%+1
:PROClive
  810 IF ?&70=0 Y%=Y%-2:SOUND1,1,50,1
  820 IF ?&70=148 OR ?&70=143 Y%=Y%-1
  830 ENDPROC
  840 DEF PROCup
  850 Y%=Y%-1:PROCprintfred
  860 VDU17,3,31,X%,Y%+4,143
  870 VDU31,X%+1,Y%+4:CALL&80
  880 IF ?&70=0PROCw:Y%=Y%-1:PROCprintfr
ed:VDU17,3,17,129,31,X%,Y%+4,149,150,10,
8,8,151,152,17,128:SOUND2,3,99,1:D=Y%+5:
REPEAT:D=D+1:VDU31,X%,D,32:PROCdelay(60)
:UNTIL D=UP%:UP%=0
  890 ENDPROC
  900 DEFPROCw
  910 VDU31,X%,Y%
  920 VDU32,10,8,32,10,8,32,10,8,32
  930 ENDPROC
  940 DEFPROCdripfall
  950 VDU31,37,D%,17,3,32
  960 IF D%=23 AND X%=37:SOUND&12,2,150,
8:D%=9:L%=L%+1:s%=s%+5:PROCupdate
  970 IF D%=27 SOUND0,4,6,3:D%=9
  980 D%=D%+1:VDU31,37,D%,144
  990 ENDPROC
 1000 DEF PROCtune
 1010 RESTORE 1080
 1020 FORU=1TO17
 1030 READ A,B
 1040 SOUND1,2,A-48,B
 1050 SOUND2,2,A-48,B
 1060 NEXT
 1070 ENDPROC
 1080 DATA165,5,161,5,165,5,161,5,165,5,
145,5,157,5,149,5,137,10,101,5,117,5,137
,5,145,10,117,5,149,5,145,5,137,20
 1090 DEFPROCtipbucket
 1100 IF X%=0 OR X%=39 U%=-U%:PROCw:X%=X
%+U%:PROCprintfred
 1110 L%=L%-1:PROCupdate
 1120 SOUND1,3,140,1
 1130 IF U%=1 VDU31,X%,Y%,17,1,145
 1140 IF U%=-1 VDU31,X%,Y%,17,1,146
 1150 S%=Y%:COLOUR3
 1160 VDU31,X%+U%,S%,32
 1170 S%=S%+1:VDU31,X%+U%,S%,144
 1180 PROCdripfall:PROCdelay(50)
 1190 VDU31,X%+U%,S%+1:CALL &80
 1200 IF ?&70=0 OR ?&70=143 VDU31,X%+U%,
S%,32:PROCprintfred:ENDPROC
 1210 IF ?&70=148 THEN VDU31,X%+U%,S%+1,
147:SOUND0,4,7,4:VDU31,X%+U%,S%,32:PROCd
elay(99):VDU31,X%+U%,S%+1,32:PROCprintfr
ed:s%=s%+100:temp%=temp%-5:PROCupdate:EN
DPROC
 1220 GOTO1160
 1230 DEFPROCbombs
 1240 COLOUR2:VDU31,F%(C%),H%(C%)
 1250 VDU32,32,10,8,8,32,32
 1260 IF H%(C%)<J%(C%) OR H%(C%)>K%(C%)
THEN I%(C%)=-I%(C%)
 1270 H%(C%)=H%(C%)+I%(C%)
 1280 VDU31,F%(C%),H%(C%),155
 1290 VDU17,RND(2),155+RND(2)
 1300 VDU17,2,10,8,8,153,154
 1310 ENDPROC
 1320 DEF PROCupdate
 1330 VDU17,129,17,3,31,6,0,32
 1340 IF L%>99 VDU8:IF L%>999 L%=999
 1350 PRINT;L%;" "
 1360 PRINTTAB(17,0);s%
 1370 VDU31,35,0:IF temp%=100VDU31,34,0
 1380 PRINT;temp%;"C "
 1390 IF temp%=90 VDU19,3,9;0;
 1400 IF temp%=85 VDU19,3,6;0;
 1410 COLOUR128
 1420 ENDPROC
 1430 DEF PROCfire
 1440 temp%=temp%+5
 1450 M%=TIME MOD pl%:M%=M%*3
 1460 N%=O%(M%)+TIME MOD(O%(M%+2))
 1470 VDU17,2,31,N%,O%(M%+1),148
 1480 IF TIME MOD3=1VDU17,3,31,N%,O%(M%+
1),144:temp%=temp%-5
 1490 IF TIME MOD40=1VDU17,2,31,N%,O%(M%
+1),128
 1500 VDU17,3,17,129
 1510 PRINTTAB(35,0);temp%;"C "
 1520 T%=T%-10
 1530 PRINTTAB(21,29);T%;" "
 1540 COLOUR128:B%=0
 1550 ENDPROC
 1560 DEFPROCfactory
 1570 CLS:X%=14:Y%=10:Z%=0
 1580 PROCprintfred
 1590 PRINTTAB(12,7)"Entering factory"
 1600 COLOUR3:PRINTTAB(29,7);sc%
 1610 COLOUR2
 1620 PRINTTAB(17,13)"Get Ready"
 1630 PROCtune:PROCdelay(5000)
 1640 FORT=0TO13
 1650 PROCleft:PROCdelay(99)
 1660 NEXT
 1670 CLS:IF sc%=3 PROCchase
 1680 VDU17,3,17,129
 1690 RESTORE3100:IF sc%>1 PROCread
 1700 READ n%
 1710 FORM%=0TOn%
 1720 READX%,Y%,Z%
 1730 FORC%=X%TOZ%STEP2
 1740 VDU31,C%,Y%
 1750 VDU149,150,10,8,8,151,152
 1760 NEXT:NEXT
 1770 COLOUR128:READ n%
 1780 FORT=0TOn%
 1790 READx%,y%:VDU31,x%,y%,143
 1800 NEXT
 1810 READ n%
 1820 FORT=0TOn%:READ X:O%(T)=X:NEXT
 1830 READ pl%:FORT=0TO2
 1840 READ F%(T),H%(T),I%(T)
 1850 READ J%(T),K%(T)
 1860 NEXT
 1870 COLOUR128
 1880 VDU31,38,7,139,140,10,8,8,141,142
 1890 Y%=24:X%=37:C%=1:Z%=0:PROCprintfre
d:COLOUR129
 1900 PRINTTAB(0,0)SPC(40)
 1910 PRINTTAB(0,29)SPC(40)
 1920 PRINTTAB(1,0)"Drips"
 1930 PRINTTAB(11,0)"Score"
 1940 PRINTTAB(23,0)"Temperature"
 1950 PRINTTAB(16,29)"Time"
 1960 COLOUR3:PRINTTAB(21,29)"400"
 1970 PROClive:PROCupdate
 1980 ENDPROC
 1990 DEF PROCcongrats
 2000 SOUND1,2,101,1
 2010 VDU28,12,17,28,11:CLS
 2020 PRINTTAB(3,1)"BONUS  2000"
 2030 PRINTTAB(4,3)"FACTORY ";sc%
 2040 PRINTTAB(4,4)"COMPLETED"
 2050 VDU26:sc%=sc%+1:F%=F%-10
 2060 PROCdelay(999)
 2070 FORT=0TO19:s%=s%+100:PROCupdate
 2080 PROCdelay(200):SOUND1,2,T*3,1:NEXT
 2090 PROCdelay(4000):ENDPROC
 2100 DEF PROCchase
 2110 X%=38:b%=38
 2120 PRINTTAB(17,4)"Help !!"
 2130 PROCleft
 2140 IF X%>32 PROCdelay(70):GOTO2130
 2150 VDU31,b%,12,32,32,10,8,8,32,32
 2160 b%=b%-1
 2170 VDU31,b%,12,155,17,RND(2)
 2180 VDU156+RND(2)-1
 2190 VDU17,2,10,8,8,153,154
 2200 PROCdelay(30)
 2210 IF X%=1 PROCw
 2220 IF b%=0 CLS:ENDPROC
 2230 IF X%=1 PROCdelay(70):GOTO2150
 2240 GOTO2130
 2250 DEF PROCdie
 2260 SOUND0,2,6,1
 2270 FORT=0TO16
 2280 VDU19,0,T;0;19,1,T;0;
 2290 VDU19,2,T;0;19,3,T;0;
 2300 PROCdelay(30):NEXT
 2310 VDU19,1,1;0;19,2,3;0;
 2320 VDU19,3,6;0;17,3
 2330 li%=li%-1:IF li% PROClive:ENDPROC
 2340 CLS:IF s%>hs% PROCenter
 2350 COLOUR2
 2360 PRINTTAB(15,1)"FRED DRIP"
 2370 COLOUR1:PRINTTAB(10,3)"By Matthew
Eastmond"
 2380 COLOUR3:PRINTTAB(9,6)"The factory
blew up !"
 2390 PRINTTAB(9,10)"Your score : ";s%
 2400 PRINTTAB(9,13)"High score : ";hs%
 2410 PRINTTAB(9,16)"Set by ";hs$
 2420 X%=29:Y%=10:PROCprintfred:li%=3
 2430 PRINTTAB(6,26)"Press space for new
game ..."
 2440 REPEAT UNTIL GET=32
 2450 sc%=1:s%=0:F%=33:L%=0:ENDPROC
 2460 DEF PROCenter
 2470 PRINTTAB(13,2)"NEW HIGH SCORE !!"
 2480 PRINTTAB(13,8)"Enter your name :"
 2490 *FX15,1
 2500 COLOUR2:INPUTTAB(13,14)hs$
 2510 IF LEN(hs$)>16 hs$=LEFT$(hs$,16)
 2520 hs%=s%:CLS
 2530 ENDPROC
 2540 DEF PROCtitle
 2550 VDU19,3,6;0;17,2:CLS
 2560 PRINTTAB(4,4)"Welcome to the world
of Fred Drip":PRINTTAB(11,8)"Hit space
to begin"
 2570 REPEAT VDU31,19,13,155
 2580 VDU17,RND(2),155+RND(2)
 2590 VDU17,2,10,8,8,153,154
 2600 SOUND0,-7,3+RND(3),1
 2610 UNTIL INKEY0=32
 2620 SOUND0,2,6,1:PROCdelay(99)
 2630 VDU19,0,1;0;:PROCdelay(50)
 2640 CLS:VDU19,0,0;0;:PROCdelay(2000)
 2650 ENDPROC
 2660 DEF PROCread
 2670 FORT=1TOsc%-1:READ n%
```

This is one of hundreds of programs now available FREE for downloading on MicroLink

Checksums: *Use the new checksum generator – from the February 1989 issue of* The Micro User – to check the accuracy of your typing when keying in this listing.

```
 2680 FORY=0TOn%::READ a%,a%,a%:NEXT
 2690 READ n%:FORZ=0TOn%
 2700 READ a%,a%:NEXT:READ n%
 2710 FORX=0TOn%:READ a%:NEXT:READ a%
 2720 FORD=0TO14:READ a%:NEXT:NEXT
 2730 ENDPROC
 2740 DEF PROClive
 2750 IF li%>6 li%=6
 2760 COLOUR129:COLOUR2
 2770 PRINTTAB(0,29)SPC(6)
 2780 FORT=1TOli%*2STEP2
 2790 VDU31,T,29,128
 2800 NEXT
 2810 COLOUR128
 2820 ENDPROC
 2830 DEFPROCsetup
 2840 D%=8:B%=0:UP%=0:T%=400
 2850 IF sc%>3 T%=800
 2860 temp%=0:hs%=3000
 2870 hs$="The Micro User"
 2880 ENDPROC
 2890 DEFPROCinit
 2900 VDU23,1,0;0;0;0;
 2910 DIM F%(2),H%(2),I%(2)
 2920 DIM J%(2),K%(2),O%(18)
 2930 sc%=1:s%=0:F%=33:L%=0:li%=3
 2940 U%=-1:P%=&80
 2950 [OPT2:LDA#135:JSR&FFF4
 2960 STX&70:RTS:]:ENDPROC
 2970 DEF PROCdelay(t%):t%=TIME+t%/20
 2980 REPEATUNTILTIME>t%:ENDPROC
 2990 DEF PROCfinished:COLOUR2:CLS
 3000 PRINTTAB(15,4)"Well done !!"
 3010 PRINTTAB(8,8)"You have completed t
he four"
 3020 PRINTTAB(16,10)"factorys."
 3030 COLOUR3:PRINTTAB(12,14)"Now do it
again !!!"
 3040 COLOUR2:PROCdelay(6000)
 3050 SOUND1,5,37,20
 3060 PRINTTAB(15,18)"Press  space"
 3070 sc%=1:REPEAT UNTIL INKEY-99
 3080 VDU19,3,6;0;
 3090 ENDPROC
 3100 DATA13,0,28,39,0,26,8,0,24,6,0,22,
5,0,20,2,10,20,21,12,18,21,14,16,25,0,12
,8,2,10,10,4,8,16,20,6,25,26,8,31,28,20,
35
 3110 DATA2,0,19,24,15,28,19
 3120 DATA17,10,27,25,15,15,8,5,7,12,28,
19,7,20,5,4,26,7,5,6
 3130 DATA24,19,1,19,24,22,20,-1,19,24,1
2,11,-1,11,15
 3140 DATA11,0,28,39,3,21,9,9,15,26,11,1
3,28,19,17,26,21,19,26,23,21,30,6,6,20,4
,8,6,2,10,6,0,12,4,26,6,32
 3150 DATA3,0,27,9,20,27,20,30,20
 3160 DATA14,1,27,34,7,5,13,3,20,5,26,5,
6,11,12,17,5
 3170 DATA15,19,1,18,24,17,19,-1,18,24,2
,3,1,2,7
 3180 DATA13,0,28,39,29,21,33,22,21,27,1
5,21,20,0,26,10,0,24,8,0,22,4,0,16,2,2,1
4,16,0,7,12,16,7,20,22,14,23,24,12,25,26
,10,27
 3190 DATA5,33,27,26,27,19,27,0,21,6,13,
16,13
 3200 DATA17,29,20,3,22,20,3,15,20,3,0,6
,13,7,13,8,17,6,4,6
 3210 DATA6,20,1,17,21,19,15,1,10,18,26,
4,1,2,7
 3220 DATA11,0,28,39,16,26,28,18,24,26,2
0,22,24,14,16,26,12,18,14,10,20,12,6,12,
9,9,10,10,11,9,20,2,6,6,26,6,34
 3230 DATA3,8,27,22,21,4,27,26,15
 3240 DATA17,14,15,7,26,5,8,11,8,8,0,27,
3,2,5,5,9,27,5,6
 3250 DATA11,4,1,6,1,30,20,1,26,8,14,23,
-1,25,20
 3260 MODE7:REPORT
 3270 PRINT" at line ";ERL
 3280 END
```

Get it right!

```
  10 =    0 0
  20 =    0 0
  30 =    0 0
  40 = 4ACF F
  50 = 7667 5
  60 = B139 1
  70 = 2E81 1
  80 = AAD6 B
  90 = CCA8 0
 100 = F7BC A
 110 =  F83 9
 120 = 8012 C
 130 = C508 6
 140 = 9791 1
 150 = 9BE6 8
 160 = 4F2D 0
 170 = E2E2 3
 180 = E566 5
 190 = F0F7 A
 200 = C985 D
 210 = 41E4 1
 220 = E3FA C
 230 = 5DEC 8
 240 = FD2E 3
 250 =  E65 3
 260 = 2E78 6
 270 = DEBB 4
 280 = 5255 B
 290 = BFBA E
 300 = 81CC 2
 310 = 83F9 9
 320 = BFBA 8
 330 = 6B0B 4
 340 = 8F58 A
 350 = F43E D
 360 = F8C0 E
 370 = 7883 4
 380 = E40E B
 390 = C29B F
 400 = 4692 F
 410 = D5B7 4
 420 =  620 6
 430 = 226C 9
 440 = F567 8
 450 = 1716 D
 460 = 47AF 8
 470 = 3E9F 9
 480 = F20A 2
 490 = 231F 9
 500 = 8457 7
 510 = DA78 D
 520 = 2E03 3
 530 = 185A 8
 540 = 9F16 E
 550 = 30EA F

 560 = 49B5 2
 570 = C254 A
 580 = ED0F C
 590 = 4540 0
 600 = AB5C 4
 610 = 873D 8
 620 = 1693 1
 630 =  70C 1
 640 = ED0F 6
 650 =  1BF 0
 660 = D4B9 2
 670 = 3EBE B
 680 = AC99 2
 690 = D2C5 C
 700 = D5BA C
 710 = ED0F 4
 720 = 1C5D A
 730 = AB5C E
 740 = 8C03 2
 750 = 1693 3
 760 = 2B0D A
 770 = ED0F 3
 780 = CCBB 5
 790 = 2AAC 8
 800 = E576 7
 810 = 53C7 E
 820 = A040 1
 830 = ED0F 0
 840 = 25DF 2
 850 = BE74 C
 860 = 204E 4
 870 = 4F7C 0
 880 = 21F1 5
 890 = ED0F B
 900 = 5C16 F
 910 = 213E 6
 920 = 6F5C F
 930 = ED0F B
 940 =  5DB A
 950 = 24CA 6
 960 = 581A 8
 970 = C4CB F
 980 = 4FC8 2
 990 = ED0F 6
1000 = 4AE3 7
1010 = BE49 9
1020 = A373 C
1030 = E75A 9
1040 = 4BBF 2
1050 = FA70 6
1060 = 2C83 F
1070 = ED0F 3
1080 = 6F48 1
1090 = B8C8 C
1100 = 619B 8

1110 = FFC4 8
1120 = 856C 3
1130 = 123C F
1140 = A1B5 C
1150 = 88A5 B
1160 = E882 5
1170 = B92C 9
1180 = 75E2 B
1190 = E0E8 E
1200 = C757 E
1210 = 9174 8
1220 = 7408 4
1230 = 9B7D D
1240 =  FB5 E
1250 = 5ABB 3
1260 = 2252 A
1270 = 693F 0
1280 = 1D94 3
1290 = F37D 1
1300 = 8F51 F
1310 = ED0F 1
1320 =  548 D
1330 = 34B5 B
1340 = E226 6
1350 = 2880 E
1360 = AFB9 E
1370 = DD25 3
1380 = 34B0 0
1390 = 86DA 5
1400 = 19F6 2
1410 = A76B 7
1420 = ED0F 0
1430 = CC30 3
1440 = F177 2
1450 = AD4C 6
1460 = 19A0 B
1470 = 103C 6
1480 = 7A93 B
1490 = FC1B B
1500 = 7367 9
1510 = D94E 8
1520 = 61C8 7
1530 =  BCE C
1540 = EB65 B
1550 = ED0F 3
1560 = 6E5F 2
1570 = DE28 8
1580 = B27D 5
1590 = 5F71 8
1600 = A446 1
1610 = D92A D
1620 = A28C 6
1630 = 878D D

1640 = D0E3 D
1650 = FF82 4
1660 = 2C83 D
1670 =  121 5
1680 = 7367 2
1690 = D747 1
1700 = DEB5 7
1710 = F362 3
1720 = 9578 4
1730 = CB04 D
1740 = C99B 0
1750 =  A16 1
1760 = 24BD 8
1770 = 9E88 3
1780 = BC95 9
1790 = CEB6 7
1800 = 2C83 9
1810 = DEB5 5
1820 = BB76 6
1830 =  2C6 C
1840 =  7AB 6
1850 = D72C E
1860 = 2C83 8
1870 = A76B 7
1880 = 7DCD 6
1890 = 28D3 0
1900 = B1A4 6
1910 = 4ECF E
1920 = 1914 6
1930 = 91FB A
1940 = 4441 9
1950 = 2B77 2
1960 = 6FA1 B
1970 =  86F D
1980 = ED0F 5
1990 =  C63 8
2000 = C0CC A
2010 = 2E1C D
2020 = F42B 2
2030 = D2F5 B
2040 = F390 B
2050 = 2721 5
2060 = E53F 1
2070 = 4F88 3
2080 = 2E5A 7
2090 = A328 B
2100 = F2C6 2
2110 = B910 3
2120 = D1A1 F
2130 = 8231 E
2140 = 3E79 C
2150 =  F33 6
2160 =  720 0
2170 =  BD8 1
2180 = FE23 F

2190 = 8F51 3
2200 = 9466 F
2210 =  8BB 7
2220 = C931 0
2230 = FD33 3
2240 = 9C99 E
2250 = 5A7C C
2260 = 7C03 2
2270 = 8046 2
2280 = 2EA5 C
2290 = E83C F
2300 = 1E92 5
2310 = 7130 B
2320 = 5601 2
2330 = B6D7 B
2340 = DFD5 B
2350 = D92A A
2360 = CA9A C
2370 = A969 C
2380 = 26D5 1
2390 = CC8A 1
2400 = B840 D
2410 = DD42 A
2420 = 37C0 0
2430 =  BF9 D
2440 = 2B9E 5
2450 = 76D2 2
2460 = 7B4A A
2470 = 7887 4
2480 = 5956 6
2490 = 7CA7 A
2500 = 8C29 4
2510 = BCF6 E
2520 = B0CB 7
2530 = ED0F 1
2540 = 5C22 8
2550 = 1340 D
2560 = E041 3
2570 =  15A 7
2580 = F37D B
2590 = 8F51 0
2600 = 78DA 8
2610 = FAB1 1
2620 = EDD1 0
2630 = 9635 D
2640 = A1A1 A
2650 = ED0F E
2660 = 2E06 C
2670 = 1CB5 6
2680 = 3E6C 6
2690 = C8B1 9
2700 = 113D 6
2710 = 4DA2 2
2720 = F899 F
2730 = ED0F E

2740 = 685F 7
2750 = A0AA B
2760 = 4226 2
2770 = E1C1 0
2780 = 6E1F D
2790 = FBA2 C
2800 = 2C83 6
2810 = A76B 4
2820 = ED0F E
2830 = 2AA8 5
2840 = D5D4 8
2850 = 2036 1
2860 = 86E9 7
2870 = 2951 1
2880 = ED0F D
2890 = 344C 5
2900 = 1E64 8
2910 = 70C7 7
2920 = EC78 4
2930 = DFD8 9
2940 = 7077 E
2950 = AA9C 8
2960 = 49FA 9
2970 = 34C3 A
2980 = 6A00 2
2990 = 244B 2
3000 = E801 F
3010 = 4B9E 5
3020 = 13A9 5
3030 =  4E9 7
3040 = E86B 9
3050 = FD49 C
3060 = CB4F 3
3070 = 853A F
3080 = 1B81 C
3090 = ED0F C
3100 = 6043 2
3110 =  CE3 4
3120 = 4343 9
3130 = B77A D
3140 = A3F4 A
3150 = 8F3E B
3160 = 9121 6
3170 = B63E 4
3180 = C020 D
3190 = 6AE7 5
3200 = 62FD 7
3210 = 7B1B 3
3220 = 4972 F
3230 = AEB2 A
3240 = B7DF E
3250 = F845 0
3260 = BF47 3
3270 = F321 C
3280 = FD2E 7
```

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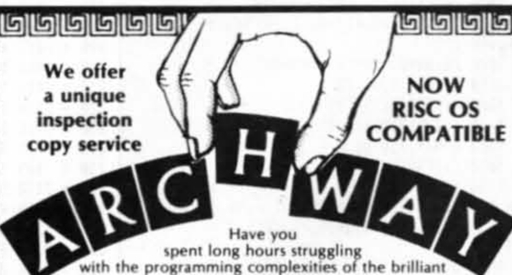

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Impressive piece of programming

I WAS intrigued by the 3D Asteroids game in your March issue, so I typed it in – something I haven't done in a long time. I was impressed with its speed, especially considering all the lines were hidden line removed.

Being a professional programmer for the past six years being impressed isn't something I often admit to these days.

Although I usually stick to writing arcade games, I have recently been dabbling with 3D maths but I was intrigued, to say the least, with Mr Pirie's hidden line algorithm.

I'd like to see the assembly language version of 3D Asteroids, but I assume it was presented in object code format to protect Mr Pirie's algorithms within.

If this was the case I can't say I'd blame him, as I am pretty protective with my source code.

Congratulations on publishing an excellent piece of code. – **Paul Hughes, Wigan Lancs.**

● Unfortunately the assembly language version would be far too long to publish. Where possible we prefer to publish programs in a form that our readers can see and even change algorithms to suit their own needs.

But with long, quality programs like 3D Asteroids we feel that it's best to publish them in the shortest form possible.

Splitting adventures

I AM working on a large adventure for my BBC Micro and need to split it into separate programs. I am having trouble in transferring variables between them. For example, I need to transfer the variable INV$ *– the adventurer's inventory.*

Could you please explain how to do this? – **Robert Owen, Acton Trussell, Stafford.**

● Carrying a single string over can be achieved easily with:

```
$&700=INV$
```

just before you exit and:

```
INV$=$&700
```

as you enter the new program.

Win a tenner

● **Want to write to The Micro User? The address is: Letters, The Micro User, Europa House, Adlington Park, Adlington, Macclesfield SK10 4NP.**

Writers of the most interesting letters receive a £10 prize.

Accessing symbols

I HAVE an Epson LX800 printer connected to my BBC Micro and use Wordwise on this system to write reports. I recently came across a way to make life a lot simpler when printing my documents which often use Greek letters for equations and so on.

These symbols are available on the LX800 by using the IBM character set – characters 24-238. If you set DIP switch 1-3 up they can be printed by sending the appropriate codes to the printer – in the case of Wordwise-Plus using the OC embedded command OC224 would print out alpha.

What the printer manual doesn't make very obvious is even if you select the IBM set instead of the italic ones, italics can still be printed.

This is achieved by sending the codes ESC"4" to the printer to turn italics on, and ESC"5" to turn it off again. The Wordwise Plus command ES sends the Escape code to the printer, so to turn italics on use ES"4" and off ES"5".

Another useful feature of the LX800 is a sheet end perforations skipover. If you set DIP switch 2-3 up the printer will leave three blank lines either side of the perforation.

But you must remember to set up the printer with the print head directly in line with a perforation before you switch it on.

Finally, if you intend to use the NLQ mode – and let's face it, it does look a lot better – double strike doesn't work. One way round this is to set the double strike command to use emphasised letters.

To do this, reprogram the print sequence for DS and DE using the RPS command. The correct commands are:

RPS 2,27,"E"	Emphasised on
RPS 3,27,"F"	Emphasised off

– **Ian Robertson, Maybole, Ayrshire.**

Right boot to play

IN your March 1989 Letters Mr. G. Bright, from Chelmsford, wrote that he could not get some Superior games to run. You rightly replied that it was his DFS, the Solidisk 2.2, that was to blame.

*Your advice was to use another DFS, but the answer is actually obtained rather more cheaply. Type *MASK-OFF before booting the game. This advice is in the Solidisk handbook and works with all Superior games, but not with the latest Tynesoft ones.*

Although the Solidisk DFS's non-standard – double density if you require it, multiple catalogues and a host of useful commands and utilities – it is far superior to the Acorn DFS in many ways.

Sadly some of the very latest educational programs – Sherston's software, 4Mation's Worlds Without Words and Tedimen's Advanced Folio – will not run with any version of the Solidisk DFS, although the Solidsk ADFS will still run everything. If Mr. G. Bright is an educational user your advice is still valid. – **D. Wisnia, Leeds.**

Lower case by accident

AS I was typing away at my keyboard I had quite a shock. As I kept the Shift key down while typing out a keyword it appeared in lower case.

This worried me at first, but resulted in being very useful for typing in programs which have lower case variables.

I discovered that I'd done it

Turn to Page 120 ▶

◄ From Page 119

by holding down Shift, pressing and releasing Caps Lock and then releasing Shift.

The Caps Lock LED will be lit and typing at the keyboard will be normal, but when Shift is pressed letters typed will be lower case. This is something I can't find in my User Guide.

Other things I've found which don't seem to be mentioned in the guide are that a comma after NEXT is interpreted as NEXT:NEXT and the full stop can be printed as in:

```
PRINT.
```

It has the value zero, and so is FALSE. Do you know of any other such things? – **Mark Wright, Doncaster.**

● Although NEXT, acts as NEXT:NEXT it is best to avoid it because the comma is easily missed as the program is read. However, if you are pushed for memory and one byte makes a difference it could be useful.

The use of . for zero is interesting and it even works like this:

```
A=.
```

which gives us a clue as to what's going on. The number decoder in the Basic expression evaluator allows all the following forms of zero:

```
0.0
0.
.0
```

and, as it happens, the full point on its own. Apart from confusing listings, the only useful purpose this could serve is that it saves ink when printing – but not a lot.

Have any of our readers useful tips? Write in and let us know.

Decimal places

PLEASE could you help me with a program I am writing on my BBC Micro? I want it to display mathematical solutions to two decimal places.

In a program I've written to calculate interest the micro displays total answers in the form £30, but I want it to show £30.00.

Finally, can you tell me the command which makes negative numbers into positive ones? –**Kevin Dyson, Pontefract, West Yorks.**

● The variable @% is used to control the output format. To give the result you require put @%=&20209 in the initialisation routine of your program. There are full details in the User Guide.

The function ABS converts negative numbers to positive so, for example, ABS(–5)=5 and ABS(5)=5.

ALL programs printed in this magazine are exact reproduction of listings taken from running programs which have been thoroughly tested.

However, on the rare occasions when mistakes occur corrections are published as a matter of urgency. Should you encounter error messages when you type in a program, they will almost certainly be the result of your own typing mistakes.

Unfortunately we can no longer answer personal programming queries concerning these mistakes. Of course letters about suggested errors will be investigated without delay, but any replies found necessary will only appear in the letters pages.

£10 Prize letter

Sound interrupts

I AM sure many people wonder how companies such as Superior Software and Impact have music playing in their games while other things are executed.

The answer is interrupts and the following program shows how this works.

*The address of the music program is stored in &220 and &221 in a high byte and low byte system. A *FX command then sets the type of interrupt to be used and starts it – in this case every time the screen is updated – 50 times a second.*

*The *KEY commands at the start of the program will turn the interrupt on and off if the keys are pressed.*

*The music is created by changing the bell sound using *FX commands again, and the pitch of the notes is changed using *FX 213.*

The pitch of each should be stored in &3000 onwards and the duration of each in &3100 up. The number of notes to be played should be stored in the variable length, *not longer than 255 notes.*

```
   10 MODE135
   20 *FX13 4
   60 *KEY0 *FX13 4|M
   70 *KEY1 *FX14 4|M
   80 FORT%=0TO3STEP3
   90 P%=&900:length=100:pit
ch=&72:pitch2=&74:dura=&77
  100 [OPTT%
  120 LDA#0:STA&73:LDA#0:STA
&76:LDA#8:STA dura
  140 LDA#init
MOD256:_STA&22
0
  150 LDA#init DIV256:STA&22
1
  160 LDA#8:STA&71:STA&70
  170 LDA#14:LDX#4:LDY#0:JSR
&FFF4
  180 RTS
  190 .init
  200 DEC&70:BNE return
  201 LDA#15:LDX#0:LDY#0:JSR
&FFF4
  210 LDA&77:STA&70
  220 INC&73:LDA&73:TAY:LDA&
3000,Y:ST32A pitch:STA
pitch2:
CLC:LDA pitch2:ADC#32:STA pi
tch2:INC&76:LDA&76:TAX:LDA&3
100.X:STA dura
  230 LDA&73:CMP#length:BNE
cont
  240 LDA#0:STA&73:LDY#0
  245 LDA#0:STA&76:LDY#0
  250 .cont
  260 LDA#214:LDX#10:LDY#0:J
SR&FFF4:LDA#211:LDX#1:LDY#0:
JSR&FFF4:LDA#213:LDX&72:LDY#
0:JSR&FFF4:LDA#7:JSR&FFEE
  270 LDA#211:LDX#2:LDY#0:JS
R&FFF4:LDA#213:LDX&74:LDY#0:
JSR&FFF4:LDA#7:JSR&FFEE
  280 .return RTS
  290 ]:NEXT:CALL &900
```

This program should work on all 8 bit BBC Micros. – **Mark Walters, West Deeping, Peterborough.**

Adjusting Dumpout

THE letter from D.A. Patterson in your March issue concerning Dumpout 3 rang a very loud bell with me. My copy of Dumpout lay idle in my machine for many months through the very same problem – I have a Centronics GLP which I think is the same machine as the M1009.

*After a concerted effort with the printer's user manual I finally cured the trouble: Before using *GIMAGE send VDU2 to enable printer then enter:*

```
VDU1,27,1,51,1,23
```

This is:

```
ESC "3" n
```

in the manual's terms and sets the line feed to n/216 inches.

I've found 3-D Asteroids on your March disc runs with invisible asteroids then crashes. I have switched off all surplus roms to no avail. Have you any idea what may be wrong? – **Graham Lowe, Ipswich,**

● The only thing that we can think may cause your 3D Asteroids problem is that you are using shadow ram. If you switch it off the game should run.

Go slower by mouse

IF you've always wanted a Slowmo and never got one you can use your AMX mouse to do the same job. Slow down games and utilities to an easier pace by just moving the mouse about. The faster you move it while a program is running the slower the program runs.

This idea works on the principle that the CPU has to take time to acknowledge that the mouse has been moved and will therefore have to slow down the accessing time of the instructions in the game.

It's best to have a friend nearby to move the mouse for you, as it can be quite a handful trying to move it while you play the game. – **Paul J. Mason, Grantham, Lincs. (Age 12)**

● Pressing any keys that aren't used by the game will have a similar effect, so don't be cheesed off if you don't own a rodent.

Acorn rom incompatibility

£10 Prize letter

HERE are a few points that may be of interest. Firstly, despite its pressure on third party software writers to conform to various standards, Acorn seems to have tripped itself up – the ADFS and GXR are incompatible on the BBC B.

The company informs me that the only solution is to rewrite one of the roms and it will not be undertaking this.

Next curious things happen to local variables when an error occurs – they seem to be promoted. The following example shows what I mean:

```
 10 A%=0:P%=TRUE
 20 ON ERROR P%=FALSE
 30 PRINT"A%=",A%
 40 IF P% THEN PROC;A%
 50 END
 60 :
 70 DEFPROCA
 80 LOCAL A%
 90 A%=1
100 PRINT"PRESS ESCAPE"
110 REPEAT:UNTIL FALSE
120 ENDPROC
```

Although A% *has the required value of 0 the first time line 30 is executed, the second time – after Escape has been pressed – the LOCAL A% from PROCA has taken over.*

This has consequences both when debugging code with local variables and for anyone who uses error 17 – Escape pressed – to enable the user to return to the top level of a program.

As far as debugging is concerned this is advantageous as you can examine the values the program was using at the time the error occurred, although you won't have access to any variables of the same name from a higher level.

*With regard to the use of Escape for an easy return, it is bad programming to rely on the generation of an error to achieve your aims. You can use *FX 229,1 to make Escape act like the other keys and reurn Ascii code 27 or be detected with INKEY(–113). To return it to normal operation use *FX 229. Don't forget that procedure parameters are also local variables.*

Moving on to another topic, it was nice to see a Forth ram disc in the March issue – even though I can't use it myself on my BBC B. However, I must take umbrage at Martin Goose's comment about not putting the returned values from osbyte on the stack.

The following routine does just that and the packing of two registers into a single number not only reduces the use of DROP but is usually what is required anyway, for example where X and Y contain an address.

The clever bit – at least I like to think so – is to compile a jump code – HEX 4C – and the address of the machine code routine in the scratchpad area at N.

Then once the CPU registers have been loaded use a subroutine jump to the compiled instruction – N JS – After this, the CPU registers are placed back on the Forth stack.

YX is a single number where Y occupies the high byte and X the low byte. The same goes for PA where P is the processor status register and A the accumulator, Addr is the start of the required machine code routine:

```
HEX
CODECALL (YX A Addr ... YX
PA )
XSAVE STX
4C # LDA, N STA, 0 , X LDA,
 N 1+ STA, 1 ,X LDA, N 2+ S
TA,
2 ,X LDA, PHA, 5 ,X LDY, 4
,X LDA, TAX, PLA,
N JSR,
PHP, PHA, TXA,
XSAVE LDX,
4, X STA, 5 ,X STY, PLA, 2
, X STA, PLA, 3 , X STA,
POP JMP,
END-CODE
DECIMAL
```

In the event that you need to join *two single numbers to use the above, try the following code:*

```
: JOIN ( X Y ... YX ) >< + ;
```

This assumes X and Y are both in the range 0 to 255. To split *them, use:*

```
: SPLIT ( YX ... X Y ) DUP
255 AND SWAP >< 255 AND ;
```

Finally, if you need to test whether the carry flag is set upon return from the machine code routine use the following which leaves a 0 on the stack if the carry flag was clear or a 1 if it was set:

```
:CSET ( PA ... 0\1 ) >< 1 A
ND ;
```

As a very brief example of its use, here is a Forth equivalent of Basic's ADVAL function for reading joystick positions where n is 1 to 4 and the value returned is unsigned – 0 to 65535.

```
HEX
:ADVAL ( n ... ADVALn ) 80
0FFF4 CALL DROP ;
DECIMAL
```

Finally here's a short routine which I find simplifies the use of numbers in different bases in Forth. While HEX and DECIMAL are all very well, I often forget just which base I am currently using so the following creates a defining word whose use is best described by example:

```
: TBASE CREATE , IMMEDIATE
DOES> BASE @ >R @ BASE ! 32
 WORD NUM  R > BASE ! ;
```

TBASE is then used to define words which will set the value of BASE *temporarily to a particular value and hand the following word to* NUM *before returning* BASE *to its previous value.*

As an example of its use, here is the definition of a word OX which will take the word after to be in hex and OB which will assume binary.

```
16 TBASE 0X
 2 TBASE 0B
```

I have used OX – from C – but you may prefer to use & – from BBC Basic. Having defined the words, they are used as follows:

```
0X F .
0B 1111 .
```

These should both display 15 if you are still in DECIMAL. Because IMMEDIATE was included in the definition of TBASE, OX and OB are IMMEDIATE and execute within colon deifnitions.

```
: FIFTEEN 0X F . ;
```

FIFTEEN will then display 15. Because NUM *is used to interpret the word, it is possible to enter double length numbers by ending them in a dot:*

```
0x  FFFF3000.
```

This will leave a 32 bit value on the stack. These words can be forced to compile using [COMPILE] but it should be stressed that the words expect a number to be present in the input stream when they are executed:

```
: H->CB [COMPILE] 0X U. ;
: B->CB [COMPILE] 0B U. ;
H->CB F
B->CB 1111
```

The last two lines should both reproduce the response 15 as they convert hex and binary to the current base respectively. – **Grimble Gromble, Melksham, Wilts.**

Enter Einstein

In anticipation of Acorn, Mike Cook reveals what the future holds

Future perfect

MIKE Cook's feature in the April issue made my day/week/month/year. Move over Einstein. The Socratic dialogue will never be the same again. – **A. Davies, Ilkley, West Yorks.**

Prodigal returns

The Bob and Trev saga, born in the very beginning of *The Micro User*, is back summoned by popular request

Dear Trev

Yea, there will be much rejoicing in heaven when one sinner returns – and that's me. The prodigal's come home. So slaughter the fatted calf or at least defrost the vegeburgers.

Sorry it's been so long since I wrote, but life's been hectic. Andrea's off on her second Bring Bellringing to the Third World *tour, Doreen's just been off and I've been suffering from what Ruben, my psycho-facilitator, calls a mid-life crisis – though I don't know what's so new about that: All my life I've been in the middle of one crisis or other.*

Things came to a head when he asked me when was the happiest time in my life. The answer popped out before I could stop it: "When my Beeb was new and The Micro User *was stapled."*

"'A man who is tired of The Micro User *is tired of life', as Dr Johnson said," intoned Ruben.*

"Samuel Johnson?" I asked, puzzled.

"No, Stanlislaus Johnson, my GP. He's a Beeb freak."

I remember Stan from my days at the Romchester Rogues. Proud of his descent from a member of the Free Polish Airforce – and a rather too-free local girl – he spent his time trying to write a program to convert English into Polish and was always complaining that there weren't enough Zs on the keyboard.

He used to keep coming up to me asking for help when things went wrong with his listings and wouldn't be put off by my saying that it was just a bug that was going round. The general opinion was that he was a competent programmer but lacked polish.

"Is he still a member?" I sighed nostalgically. "I've lapsed."

Which was true enough. It must be two years since I'd been to a meeting of the Rogues – consequently my life insurance premiums had decreased dramatically – and even longer since I'd actually sat down at the keyboard making typing errors.

"What caused you to lose interest?" Ruben persisted, wiping his glasses on a page ripped from ITV Nut User.

"In Andrea or the Beeb?" I asked playing for time.

"Either."

"I got tired of Can't Extend *messages," I explained limply.*

"From Andrea or the Beeb?"

"Both."

Which again was true. Not that I saw that much of A. now. She was always off to meetings of her Women Against Practically Everything And Especially Anything Bob Enjoys *or trying to lose one of a pair of earrings. It was round about then that Doreen appeared on the scene. And before you say anything it's a purely platonic or, as the lads at the club insisted, archimedic relationship. Doreen, you might remember, teaches computer science at the local comprehensive and is the only living thing that Buster the cat is afraid of.*

"Isn't it significant that your affair with the Beeb started to wane when you met a woman who knew about micros?" mused Ruben, flicking through back issues of Practical Psychiatry. "I think it's about time that you renewed your relationship," he continued.

"With Andrea?" I asked, starting to panic.

"No, the Beeb."

He's right of course, I've been away far too long. Me and bug are going to be re-united. I'll let you know how we get on.

Cheers,

Bob

PS. Clive, hearing of my return to the fold from Stan, has sent me a copy of Eliza, a psychotherapeutic program. As he said, despite appearances it's really quite unintelligent, just repeating what you say and asking stupid questions. Which makes it an ideal substitute for Ruben.

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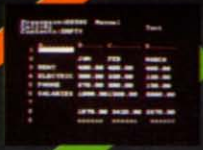
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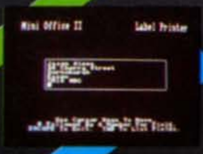

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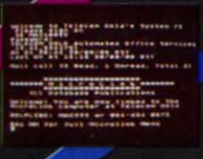
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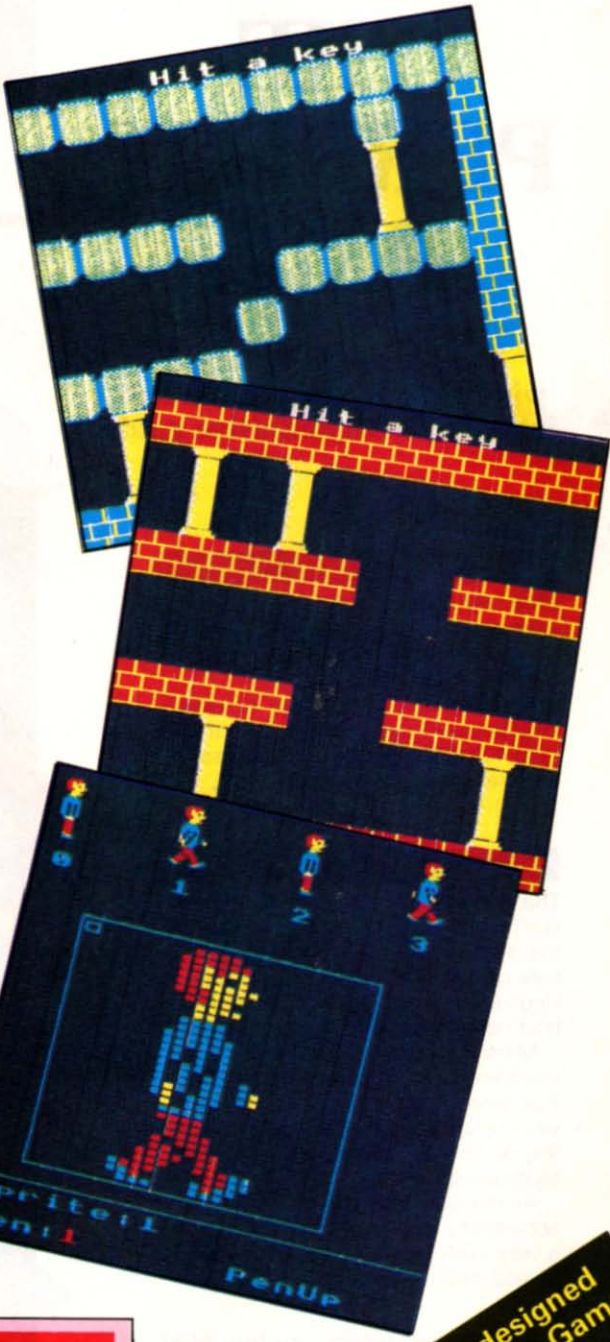

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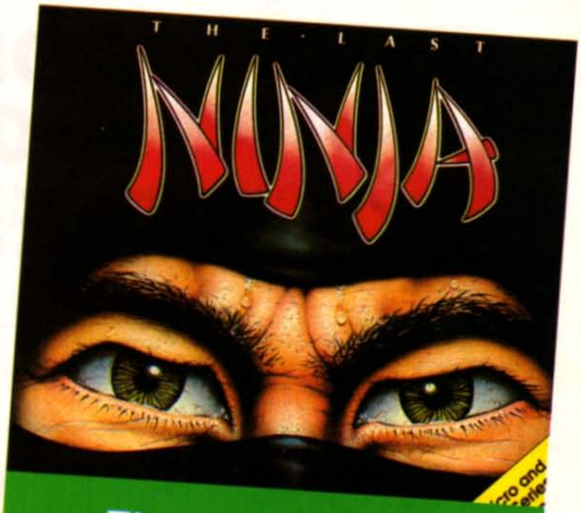
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(See page 123)

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(See page 81)

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(see page 110)

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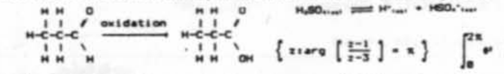

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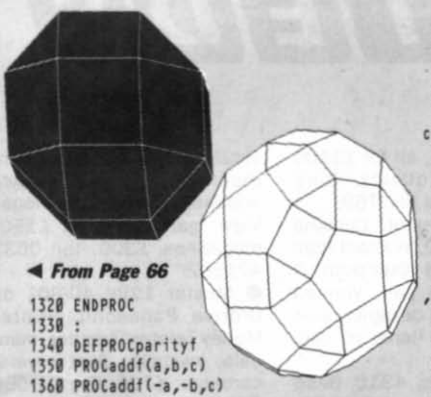
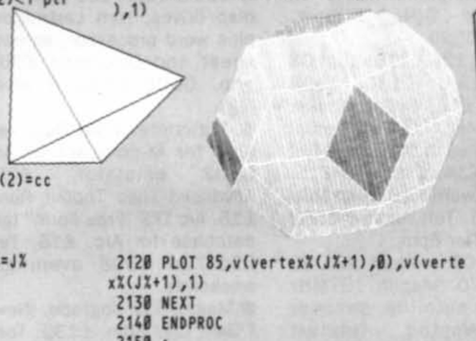


◀ From Page 66

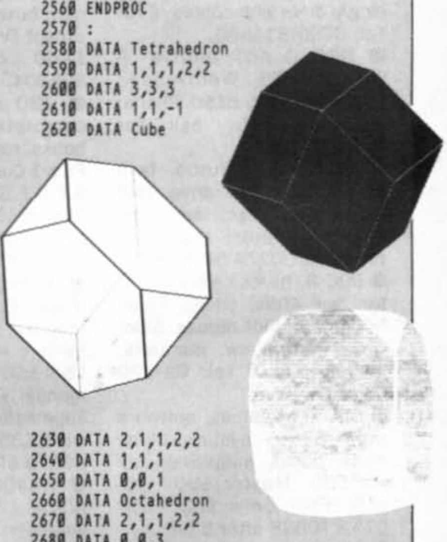
```
 1320 ENDPROC
 1330 :
 1340 DEFPROCparityf
 1350 PROCaddf(a,b,c)
 1360 PROCaddf(-a,-b,c)
 1370 PROCaddf(a,-b,-c)
 1380 PROCaddf(-a,b,-c)
 1390 ENDPROC
 1400 :
 1410 DEFPROCaddf(aa,bb,cc)
 1420 F%=F%+1:ptr%=-1
 1430 FOR J%=0 TO V%
 1440 d=v(J%,0):e=v(J%,1):f=v(J%,2)
 1450 IF ABS(aa*d+bb*e+cc*f-dist2)<1 ptr
%=ptr%+1:wkface%(ptr%)=J%
 1460 NEXT
 1470 maxptr%=ptr%
 1480 PROCsortf(aa,bb,cc)
 1490 PROCdrawf(F%)
 1500 ENDPROC
 1510 :
 1520 DEFPROCsortf(aa,bb,cc)
 1530 face(0)=aa:face(1)=bb:face(2)=cc
 1540 max=0
 1550 FOR J%=0 TO 2
 1560 size=ABS(face(J%))
 1570 IF size>max max=size:axis%=J%
 1580 NEXT
 1590 coord1=(axis%+1)MOD3
 1600 coord2=(axis%+2)MOD3
 1610 centre1=face(coord1)
 1620 centre2=face(coord2)
 1630 FOR ptr%=0 TO maxptr%
 1640 J%=wkface%(ptr%)
 1650 disp1=v(J%,coord1)-centre1
 1660 disp2=v(J%,coord2)-centre2
 1670 IF ABS(disp2)>1 angle(ptr%)=ATN(di
sp1/disp2):IF disp2<0 angle(ptr%)=angle(
ptr%)+PI
 1680 IF NOT(ABS(disp2)>1) angle(ptr%)=P
I/2*SGN(disp1)
 1690 NEXT
 1700 FOR ptr%=0 TO maxptr%-1
 1710 minangle=angle(ptr%)
 1720 pos%=ptr%
 1730 FOR K%=ptr%+1 TO maxptr%
 1740 IF angle(K%)<minangle pos%=K%:mina
ngle=angle(K%)
 1750 NEXT
 1760 W%=wkface%(ptr%)
 1770 wkface%(ptr%)=wkface%(pos%)
 1780 wkface%(pos%)=W%
 1790 angle(pos%)=angle(ptr%)
 1800 NEXT
 1810 edges%(F%)=maxptr%
 1820 FOR K%=0 TO maxptr%
 1830 IF face(axis%)>0 face%(F%,K%)=wkfa
ce%(K%) ELSE face%(F%,K%)=wkface%(maxptr
%-K%)
 1840 NEXT
 1850 ENDPROC
 1860 :
 1870 DEFPROCdrawf(fno%)
```

```
 1880 clock%=FNclockwise(fno%)
 1890 IF clock%=-1 ENDPROC
 1900 eno%=edges%(fno%)
 1910 FOR J%=0 TO eno%
 1920 vertex%(J%)=face%(fno%,J%) EOR clo
ck%
 1930 NEXT
 1940 IF clock%=1 AND step%=1 GOTO 2000
 1950 col%=1:IF fno%>F1% col%=2
 1960 IF M%=6 AND fno%>F2% col%=white%
 1970 IF M%=4 PROCplotf(0,white%)
 1980 IF M%>4 PROCplotf(0,col%)
 1990 IF M%<4 OR M%=5 PROCplote(0,white%
,5) ELSE PROCplote(0,0,5)
 2000 FOR J%=0 TO eno%
 2010 vertex%(J%)=vertex%(J%) EOR 1
 2020 NEXT
 2030 IF M%=2 PROCplote(0,white%,29)
 2040 IF M%=3 PROCplote(1,1,5)
 2050 ENDPROC
 2060 :
 2070 DEFPROCplotf(gc1%,gc2%)
 2080 GCOL gc1%,gc2%
 2090 FOR J%=1 TO eno%-1
 2100 MOVE v(vertex%(0),0),v(vertex%(0),
1)
 2110 MOVE v(vertex%(J%),0),v(vertex%(J%
),1)
```



```
 2120 PLOT 85,v(vertex%(J%+1),0),v(verte
x%(J%+1),1)
 2130 NEXT
 2140 ENDPROC
 2150 :
 2160 DEFPROCplote(gc1%,gc2%,plot%)
 2170 GCOL gc1%,gc2%
 2180 MOVE v(vertex%(0),0),v(vertex%(0),
1)
 2190 FOR J%=1 TO edges%(fno%)
 2200 PLOT plot%,v(vertex%(J%),0),v(vert
ex%(J%),1)
 2210 NEXT
 2220 PLOT plot%,v(vertex%(0),0),v(verte
x%(0),1)
 2230 ENDPROC
 2240 :
 2250 DEFFNclockwise(fno%)
 2260 x1%=v(face%(fno%,0),0)
 2270 y1%=v(face%(fno%,0),1)
 2280 x2%=v(face%(fno%,1),0)
 2290 y2%=v(face%(fno%,1),1)
 2300 x3%=v(face%(fno%,2),0)
 2310 y3%=v(face%(fno%,2),1)
 2320 IF x1%<>x2% GOTO2370
 2330 IF y1%=y2% OR x3%=x1% =-1
 2340 IF y2%<y1% GOTO2360
 2350 IF x3%>x1% =1 ELSE =0
 2360 IF x3%<x1% =1 ELSE =0
 2370 W%=(y2%-y1%)/(x2%-x1%)*(x3%-x1%)+y
1%
 2380 IF ABS(y3%-W%)<3 =-1
 2390 IF ((y3%<W%) AND (x1%<x2%)) OR ((y
3%>W%) AND (x1%>x2%)) THEN =1 ELSE =0
 2400 :
 2410 DEFPROCturnv(axis%,sign%)
 2420 coord1%=(axis%+1)MOD3
```

```
 2430 coord2%=(axis%+2)MOD3
 2440 FOR I%=0 TO V% STEP step%
 2450 W=v(I%,coord1%)*cos+sign%*v(I%,coo
rd2%)*sin
 2460 v(I%,coord2%)=v(I%,coord2%)*cos-si
gn%*v(I%,coord1%)*sin
 2470 v(I%,coord1%)=W
 2480 IF step%=2 v(I%+1,coord2%)=-v(I%,c
oord2%):v(I%+1,coord1%)=-W
 2490 NEXT
 2500 CLS:PROCredrawf
 2510 ENDPROC
 2520 :
 2530 DEFPROCredrawf
 2540 FOR I%=0 TO F%:PROCdrawf(I%):NEXT
 2550 *FX15,1
 2560 ENDPROC
 2570 :
 2580 DATA Tetrahedron
 2590 DATA 1,1,1,2,2
 2600 DATA 3,3,3
 2610 DATA 1,1,-1
 2620 DATA Cube
```



```
 2630 DATA 2,1,1,2,2
 2640 DATA 1,1,1
 2650 DATA 0,0,1
 2660 DATA Octahedron
 2670 DATA 2,1,1,2,2
 2680 DATA 0,0,3
 2690 DATA 1,1,1
 2700 DATA Dodecahedron
 2710 DATA 2,2,1,2,2
 2720 DATA 0,5,5*phi+5
 2730 DATA 5*phi,5*phi,5*phi
 2740 DATA 0,4*phi+3,3*phi+1
 2750 DATA Icosahedron
 2760 DATA 2,1,2,2,3
 2770 DATA 0,3,3*phi
 2780 DATA phi+1,phi+1,phi+1
 2790 DATA 0,2*phi+1,phi
 2800 DATA Truncated Tetrahedron
 2810 DATA 1,3,2,2,3
 2820 DATA 3,3,9
 2830 DATA 3,9,3
 2840 DATA 9,3,3
 2850 DATA 3,-3,3
 2860 DATA 5,5,5
 2870 DATA Truncated Cube
 2880 DATA 2,1,2,2,3
 2890 DATA 3,3*r2+3,3*r2+3
 2900 DATA 0,0,3*r2+3
 2910 DATA 3+r2*2,3+r2*2,3+r2*2
 2920 DATA Truncated Octahedron
 2930 DATA 2,2,2,2,3
 2940 DATA 0,1,2
 2950 DATA 0,2,1
 2960 DATA 0,0,2
 2970 DATA 1,1,1
 2980 DATA Truncated Dodecahedron
 2990 DATA 2,3,3,2,3
 3000 DATA 0,3,9*phi+3
```

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- Viglen disc drive DD/DS 80T with 20 blank discs £50. Please Tel: (Wirksworth) 062982 5215.
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- The cost is 20p per word, with a minimum of 10 words.
- *WE GUARANTEE your ad will appear in the next available issue of* The Micro User.

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```
3010 DATA 3,3*phi+3,6*phi+6
3020 DATA 3*phi+3,6*phi,6*phi+3
3030 DATA 0,2*phi+3,7*phi+5
3040 DATA 5*phi+2,5*phi+2,5*phi+2
3050 DATA 0,6*phi+3,3*phi+3
3060 DATA Truncated Icosahedron
3070 DATA 2,3,3,2,3
3080 DATA 0,5,15*phi
3090 DATA 10*phi,5,5*phi+10
3100 DATA 5*phi,10,10*phi+5
3110 DATA 0,2*phi+9,11*phi+2
3120 DATA 0,10*phi+5,5*phi
3130 DATA 5*phi+5,5*phi+5,5*phi+5
3140 DATA Cuboctahedron
3150 DATA 2,1,2,2,3
3160 DATA 0,3,3
3170 DATA 0,0,3
3180 DATA 2,2,2
3190 DATA Small Rhombicuboctahedron
3200 DATA 2,1,3,2,3
3210 DATA 6,6,6*r2+6
3220 DATA 0,0,6*r2+6
3230 DATA 0,6+3*r2,6+3*r2
3240 DATA 6+2*r2,6+2*r2,6+2*r2
3250 DATA Great Rhombicuboctahedron
3260 DATA 2,2,3,2,3
3270 DATA 2,2*r2+2,r2*4+2
3280 DATA 2,r2*4+2,r2*2+2
3290 DATA 0,0,r2*4+2
3300 DATA 0,2+3*r2,2+3*r2
3310 DATA 2+2*r2,2+2*r2,2+2*r2
3320 DATA Icosidodecahedron
3330 DATA 2,2,3,2,3
3340 DATA 0,0,30*phi
3350 DATA 15,15*phi,15*phi+15
3360 DATA 0,18*phi+6,6*phi+12
3370 DATA 10*phi+10,10*phi+10,10*phi+10
3380 DATA 0,10*phi,20*phi+10
3390 DATA Small Rhombicosidodecahedron
3400 DATA 2,3,5,3,5
3410 DATA 30,30,60*phi+30
3420 DATA 0,30*phi+30,30*phi+60
3430 DATA 30*phi+30,30*phi,60*phi
3440 DATA 0,0,60*phi+30
3450 DATA 15*phi+15,30*phi+15,45*phi+30
3460 DATA 40*phi+10,40*phi+10,40*phi+10
3470 DATA 0,10*phi+30,50*phi+40
3480 DATA 0,54*phi+18,18*phi+36
3490 DATA Great Rhombicosidodecahedron
3500 DATA 2,5,5,3,5
3510 DATA 2,2,8*phi+2
3520 DATA 4,2*phi+2,6*phi+4
3530 DATA 2*phi+4,4*phi,6*phi+2
3540 DATA 2,4*phi+2,4*phi+6
3550 DATA 2*phi+2,6*phi,4*phi+4
3560 DATA 0,0,8*phi+2
3570 DATA phi+3,4*phi+1,5*phi+4
3580 DATA 0,2*phi+2,6*phi+4
3590 DATA 4*phi+2,4*phi+2,4*phi+2
3600 DATA 0,6*phi+2,2*phi+4
3610 DATA Rhombic Dodecahedron
3620 DATA 2,2,1,2,2
3630 DATA 0,0,2
3640 DATA 1,1,1
3650 DATA 0,1,1
3660 DATA Rhombic Triacontahedron
3670 DATA 2,3,2,2,3
3680 DATA 0,2,2*phi+2
3690 DATA 2*phi,2*phi,2*phi
3700 DATA 0,2*phi+2,2*phi
3710 DATA 0,0,2*phi+2
3720 DATA phi,phi+1,2*phi+1
3730 DATA Finish
```

Get it right!

```
  10 =    0 0
  20 =    0 0
  30 =    0 0
  40 = 52BB B
  50 = DEBB 4
  60 = BCC6 F
  70 = A8DF 2
  80 =  66A 0
  90 = 530D F
 100 = 7F62 9
 110 = D818 F
 120 = 1E64 D
 130 = 7AF2 D
 140 = 1D92 5
 150 = 3567 B
 160 = 3611 F
 170 = 81F7 5
 180 =  45B 1
 190 = 4644 D
 200 = C2FB 2
 210 = D49A 2
 220 =  684 A
 230 = E014 3
 240 = 476A 2
 250 = 9A1B C
 260 = 379B 6
 270 = FD2E 0
 280 = 9719 7
 290 = 46AF 4
 300 =  189 8
 310 = 625F 3
 320 = 7B21 4
 330 = 2C83 F
 340 = 6968 3
 350 = CC3B A
 360 = FA9F B
 370 = 8760 B
 380 = 9719 1
 390 = 344C A
 400 = 8C9C 4
 410 = 55CD A
 420 = 4F5D 7
 430 = 673A E
 440 = 1251 A
 450 = 584F 2
 460 = C6E9 6
 470 = 56A0 9

 480 = 9AE5 0
 490 =  E1F B
 500 = 3A82 5
 510 = C139 B
 520 = 676A 3
 530 = 3FBD E
 540 = ED0F 4
 550 = 9719 1
 560 = 9DAB F
 570 = B5EE 4
 580 = 80CF 3
 590 = ED0F E
 600 = 9719 7
 610 = 74A2 7
 620 = AD40 5
 630 = 8AFE 9
 640 = 9719 8
 650 = F071 1
 660 = 9FF8 2
 670 = 8427 2
 680 = 8708 F
 690 = 9083 C
 700 = C52A D
 710 = E04B C
 720 = ED0F A
 730 = 9719 2
 740 = DBB7 9
 750 = 9CA2 2
 760 = 1FEE 4
 770 = 54D6 2
 780 = 2CFE 7
 790 = 56D1 C
 800 = 77B4 D
 810 = C180 8
 820 = E531 6
 830 = 9719 3
 840 = ED57 2
 850 = 53B4 B
 860 = 150B 0
 870 = C145 3
 880 = 7B48 3
 890 = E9A4 8
 900 = A6B8 3
 910 = E9A4 6
 920 = A6B8 9
 930 = CE8D 0
 940 = 1B4B 2

 950 = ED0F 1
 960 = 9719 E
 970 = EAAC 6
 980 = 6461 2
 990 = 5D7C 7
1000 = 473A E
1010 = D21B F
1020 = ED0F C
1030 = 9719 7
1040 = 7BEE F
1050 = 9E40 A
1060 = 8B75 5
1070 = C6D2 F
1080 = 9719 D
1090 = C986 B
1100 = 48CF F
1110 = 8626 A
1120 = D558 F
1130 = 16CE 6
1140 = 1FEE 3
1150 = 50C2 9
1160 = B223 D
1170 = 1C63 9
1180 = 58A5 2
1190 = 6585 3
1200 = D3B1 7
1210 = E531 D
1220 = 9719 8
1230 = FF66 2
1240 = 53B4 F
1250 = 150B 7
1260 = 59D5 B
1270 = 327B C
1280 = D410 B
1290 = D410 A
1300 = CE8D C
1310 = 1B4B D
1320 = ED0F 9
1330 = 9719 7
1340 = F89D 9
1350 = 59D5 B
1360 = C9EA B
1370 = D3AC B
1380 = 468D E
1390 = ED0F F
1400 = 9719 E
1410 = 2ED3 0

1420 = AC4D D
1430 = 13D0 2
1440 = 4C03 B
1450 = D9E4 C
1460 = 2C83 3
1470 = F221 A
1480 = A5B0 8
1490 = BD78 7
1500 = ED0F 7
1510 = 9719 0
1520 = E7C7 6
1530 = D5BB 6
1540 = 23F3 C
1550 = D42B 1
1560 = A002 7
1570 = 49DA A
1580 = 2C83 1
1590 = 7F12 0
1600 = 2B6B 1
1610 = E7CD 4
1620 = 3F3D 4
1630 = 2609 B
1640 = 2E9D C
1650 = A541 B
1660 = 9285 A
1670 = 4345 E
1680 = 1F83 0
1690 = 2C83 F
1700 = 6BA1 4
1710 = 7235 0
1720 = A49E 7
1730 = AFC7 D
1740 = 3EDA D
1750 = 2C83 B
1760 = 34E4 0
1770 = 14ED A
1780 = 50FA D
1790 = BE66 1
1800 = 2C83 7
1810 = F7A4 3
1820 =  413 D
1830 = 95D2 D
1840 = 2C83 9
1850 = ED0F E
1860 = 9719 4
1870 = BEFC 3
1880 = 4479 0

1890 = CD2C E
1900 = D6FE 3
1910 = A8E7 2
1920 = 3FC0 A
1930 = 2C83 C
1940 = A540 E
1950 = B5EA A
1960 = 2056 2
1970 = 4201 9
1980 =  819 5
1990 = 7926 6
2000 = A8E7 B
2010 = B08C C
2020 = 2C83 C
2030 =  CEF C
2040 = A795 0
2050 = ED0F D
2060 = 9719 6
2070 = 7EA5 3
2080 = 6A31 B
2090 = 2093 A
2100 = A56A 9
2110 = 105D 5
2120 = E868 C
2130 = 2C83 9
2140 = ED0F 4
2150 = 9719 0
2160 = A71E 7
2170 = 6A31 B
2180 = A56A D
2190 = A5AE 9
2200 = E6E9 4
2210 = 2C83 6
2220 = 1E4B A
2230 = ED0F B
2240 = 9719 A
2250 = EBD7 3
2260 = 1C79 C
2270 = 4290 6
2280 = D813 0
2290 = 86FA C
2300 = E337 C
2310 = BDDE F
2320 = CCB9 4

2330 =  FB6 4
2340 = 734E 2
2350 =  DC3 5
2360 =  B29 F
2370 = DB78 9
2380 = 7D63 E
2390 = ED6E 9
2400 = 9719 F
2410 = 4AD8 A
2420 = 5719 E
2430 = 4166 6
2440 = 8468 B
2450 = 9E19 0
2460 = 320F 7
2470 = 6BD3 4
2480 = 1A16 5
2490 = 2C83 7
2500 = D624 7
2510 = ED0F E
2520 = 9719 2
2530 = D924 2
2540 = EFE8 A
2550 = 7CA7 2
2560 = ED0F 6
2570 = 9719 0
2580 = 8858 A
2590 = D8E3 9
2600 = 6503 7
2610 = 5F25 B
2620 = 3010 A
2630 = F5A7 A
2640 = 6FA2 2
2650 = F2C3 6
2660 = 6281 1
2670 = F5A7 1
2680 = D281 3
2690 = 6FA2 8
2700 = C803 F
2710 = 2D25 E
2720 = BA11 1
2730 = 5F07 F
2740 = 552E 2
2750 = 95CC 1
2760 =  B54 1
2770 = 6962 1
2780 = C694 9
2790 = 8F93 F

2800 = BDD5 D
2810 = 46F3 1
2820 = C449 8
2830 = A2C2 4
2840 = 23AD 4
2850 = FCD1 2
2860 = 7AE0 6
2870 = 3D0F 5
2880 =  B54 B
2890 = 2661 A
2900 = 4E03 3
2910 = E56F 1
2920 = 4D61 E
2930 = D3D6 9
2940 = F590 5
2950 = 9CA3 C
2960 = C2A0 5
2970 = 6FA2 7
2980 = 23F5 B
2990 = C1E6 9
3000 = D234 7
3010 = 15DF 3
3020 = BEE0 D
3030 =  207 1
3040 = 3451 B
3050 = 38B5 B
3060 = A041 8
3070 = C1E6 C
3080 = CC4B 8
3090 = 7C57 5
3100 = C628 0
3110 = 8CE9 C
3120 = 1B46 2
3130 = 87B3 E
3140 = E7EA 3
3150 =  B54 7
3160 = 8BD1 2
3170 = D281 D
3180 = E843 A
3190 =  830 6
3200 = A105 4
3210 = AED3 9
3220 = 5DA7 0
3230 = F22A C
3240 = 656E A
3250 = 29EA C
3260 = 7987 0

3270 = F193 F
3280 = F5C2 F
3290 = 35BD 5
3300 = F126 D
3310 = B0AE C
3320 = 88C0 5
3330 = 7987 8
3340 = 2CE2 6
3350 = DA6D A
3360 = 2A45 1
3370 = 29BE 0
3380 = 3E24 E
3390 = CA65 4
3400 = 5B95 5
3410 = B042 4
3420 = C775 E
3430 = A478 9
3440 = E219 1
3450 = 5136 5
3460 = CB6F 0
3470 = 5780 1
3480 = 3038 C
3490 = 817F B
3500 = FAB0 C
3510 = 31E4 0
3520 =  2EC B
3530 = 8966 8
3540 = F66A C
3550 = D5EE 2
3560 = 5730 4
3570 = 2C0A A
3580 = 4164 B
3590 = 47C7 7
3600 = 1B10 5
3610 = DE27 A
3620 = 2D25 D
3630 = C2A0 D
3640 = 6FA2 C
3650 = C5F3 4
3660 = B05D 2
3670 = 6BB7 9
3680 = 6219 B
3690 = 63C0 A
3700 = 141F F
3710 = A47E 1
3720 = 2239 1
3730 = 5123 1
```

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Vertical striped colour values

Code	Colour 1	Colour 2	Code	Colour 1	Colour 2
01	red	black	02	black	red
09	red	green	06	green	red
0B	red	yellow	07	yellow	red
21	red	blue	12	blue	red
23	red	magenta	13	magenta	red
29	red	cyan	16	cyan	red
2B	red	white	17	white	red
04	green	black	08	black	green
0E	green	yellow	0D	yellow	green
24	green	blue	18	blue	green
26	green	magenta	19	magenta	green
2C	green	cyan	1C	cyan	green
2E	green	white	1D	white	green
05	yellow	black	0A	black	yellow
25	yellow	blue	1A	blue	yellow
27	yellow	magenta	1B	magenta	yellow
2D	yellow	cyan	1E	cyan	yellow
2F	yellow	white	1F	white	yellow
10	blue	black	20	black	blue
32	blue	magenta	31	magenta	blue
38	blue	cyan	34	cyan	blue
3A	blue	white	35	white	blue
11	magenta	black	22	black	magenta
39	magenta	cyan	36	cyan	magenta
3B	magenta	white	37	white	magenta
14	cyan	black	28	black	cyan
3E	cyan	white	3D	white	cyan
15	white	black	2A	black	white

```
 320 LDX#4
 330 JSR osbyte
 340 LDA#22
 350 JSR oswrch
 360 LDA#mode
 370 JSR oswrch
 380 LDA#0
 390 STA outbuff
 400 STA inbuff
 410 STA scrtop
 420 ADC robyte
 430 STA scaddr
 440 LDA himem
 450 TAX
 460 CLC
 470 ADC robyte+1
 480 STA scaddr+1
 490 TXA
 500 LSR A
 510 LSR A
 520 LSR A
 530 STA scrtop+1
 540 SEC
 550 LDA scaddr
 560 SBC#8
 570 STA scaddr
 580 LDA scbyte
 590 LSR A
 600 LSR A
 610 LSR A
 620 STA bpsdiv8
 630 SEI
 640 LDA#event MOD256
 650 STA eventv
 660 LDA#event DIV256
 670 STA eventv+1
 680 CLI
 690 LDA#14
 700 LDX#4
 710 JSR osbyte
 720 .openfile
 730 LDA#64
 740 LDX#(handle+1) MOD256
 750 LDY#(handle+1) DIV256
 760 JSR osfind
 770 STA handle
 780 .getchar
 790 LDA#126
 800 JSR osbyte
 810 INX
 820 BEQ exit
 830 LDX inbuff
 840 LDA buffer,X
 850 CMP#32
 860 BCS getchar
 870 LDY handle
 880 JSR osbget
 890 BCS repeat
 900 STA buffer,X
 910 DEC inbuff
 920 BPL getchar
 930 LDA#size
 940 STA inbuff
 950 BNE getchar
 960 BCC getchar
 970 .exit
 980 RTS
 990 .repeat
1000 LDA#0
1010 LDY handle
1020 JSR osfind
1030 JMP openfile
1040 :
1050 .hex
1060 JSR byte
1070 SEC
1080 SBC#ASC"0"
1090 CMP#10
1100 BCC nothigh
1110 SBC#7
1120 CMP#16
1130 BCS toohigh
1140 .nothigh
1150 ASL block
1160 ASL block
1170 ASL block
1180 ASL block
1190 CLC
1200 ADC block
1210 .toohigh
1220 RTS
1230 :
1240 .byte
1250 LDX outbuff
1260 LDA buffer,X
1270 CMP#32
1280 BCC outempt
1290 PHA
1300 TXA
1310 STA buffer,X
1320 PLA
1330 DEC outbuff
1340 BPL outempt
1350 LDX#size
1360 STX outbuff
1370 .outempt
1380 RTS
1390 :
1400 .event
1410 PHP
1420 CMP#4
1430 BNE notus
1440 PHA
1450 TXA
1460 PHA
1470 TYA
1480 PHA
1490 LDA colmask
1500 BNE notdone
1510 .find
1520 JSR byte
1530 CMP#ASC"|"
1540 BEQ code
1550 CMP#ASC"!"
1560 BCS char
1570 LDA#32
1580 .char
1590 STA block
1600 LDA#10
1610 LDX#block MOD256
1620 LDY#block DIV256
1630 JSR osword
1640 LDA#128
1650 STA colmask
1660 BNE notdone
1670 .code
1680 JSR byte
1690 CMP#ASC"|"
1700 BEQ char
1710 SEC
1720 SBC#ASC"0"
1730 CMP#7
1740 BCS notdone
1750 TAY
1760 JSR hex
1770 BCS notdone
1780 STA block
1790 JSR hex
1800 BCS notdone
1810 STA tbc,Y
1820 BCC find
1830 .notdone
1840 LDA colcount
1850 BNE event1
1860 LDA chw
1870 STA colcount
1880 .event1
1890 JSR column
1900 DEC colcount
1910 BNE eventend
1920 LSR colmask
1930 .eventend
1940 PLA
1950 TAY
1960 PLA
1970 TAX
1980 PLA
1990 .notus
2000 PLP
2010 RTS
2020 :
2030 .column
2040 LDX#12
2050 STX viaddr
2060 LDY scrtop+1
2070 STY vidata
2080 INX
2090 STX viaddr
2100 LDY scrtop
2110 STY vidata
2120 LDA scaddr
2130 STA cellptr
2140 LDA scaddr+1
2150 STA cellptr+1
2160 LDA#0
2170 STA cellrow
2180 STA current
2190 STA overflow
2200 STA charrow
2210 LDA tbc
2220 LDX tbh
2230 JSR fill
2240 .columnloop
2250 LDY charrow
2260 LDA block+1,Y
2270 AND colmask
2280 BNE bitset
2290 LDA bgc
2300 JMP drawbit
2310 .bitset
2320 LDA fgc
2330 .drawbit
2340 LDX chh
2350 JSR fill
2360 INC charrow
2370 LDY charrow
2380 CPY#8
2390 BCC columnloop
2400 LDA current
2410 EOR#255
2420 TAX
2430 INX
2440 LDA bbc
2450 JSR fill
2460 :
2470 CLC
2480 LDA scaddr
2490 ADC#8
2500 STA scaddr
2510 BCC cclear1
2520 INC scaddr+1
2530 BPL cclear1
2540 LDA scaddr+1
```

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```
2550 SBC scbyte
2560 STA scaddr+1
2570 .cclear1
2580 INC scrtop
2590 BNE cclear2
2600 INC scrtop+1
2610 LDA scrtop+1
2620 CMP#16
2630 BCC cclear2
2640 SBC bpsdiv8
2650 STA scrtop+1
2660 .cclear2
2670 RTS
2680 .fill
2690 BIT overflow
2700 BMI fillend
2710 STA tempcol
2720 LDY cellrow
2730 INX
2740 .fillloop
2750 DEX
2760 BEQ fillend
2770 INC current
2780 BNE fillcol1
2790 DEC overflow
2800 .fillcol1
2810 STA &FFFF,Y
2820 INY
2830 CPY#8
2840 BNE fillloop
2850 LDY#0
2860 CLC
2870 LDA cellptr
2880 ADC robyte
2890 STA cellptr
2900 LDA cellptr+1
2910 ADC robyte+1
2920 BPL notedge
2930 SEC
2940 SBC scbyte
2950 .notedge
2960 STA cellptr+1
2970 LDA tempcol
2980 JMP fillloop
2990 .fillend
3000 STY cellrow
3010 RTS
3020 .tbc
3030 BRK
3040 .bgc
3050 BRK
3060 .fgc
3070 EQUB 63
3080 .bbc
3090 BRK
3100 .tbh
3110 EQUB 64
3120 .chh
3130 EQUB 8
3140 .chw
3150 EQUB 1
3160 .scrtop
3170 EQUW 0
3180 .scaddr
3190 EQUW 0
3200 .bpsdiv8
3210 BRK
3220 .colmask
3230 BRK
3240 .cellrow
3250 BRK
3260 .charrow
3270 BRK
3280 .tempcol
3290 BRK
3300 .colcount
3310 BRK
3320 .current
3330 BRK
3340 .overflow
3350 BRK
3360 .block
3370 BRK
3380 EQUD 0
3390 EQUD 0
3400 .handle
3410 BRK
3420 EQUS "file"
3430 EQUB 13
3440 .inbuff
3450 BRK
3460 .outbuff
3470 BRK
3480 .buffer
3490 EQUD 0
3500 EQUD 0
3510 EQUD 0
3520 EQUD 0
3530 EQUD 0
3540 EQUD 0
3550 :
3560 ]
3570 cellptr=fillcol1+1
3580 size=P%-buffer-1
3590 NEXT
3600 ENDPROC
```

Get it right!

```
  10 =    0 0
  20 =    0 0
  30 =    0 0
  40 = CC7A A
  50 = C425 5
  60 = AC0C 2
  70 = EB1E 5
  80 = 1927 8
  90 = 4B19 7
 100 = C5B9 7
 110 = 9A48 2
 120 =  247 7
 130 = FA93 A
 140 =   78 4
 150 = 4EF9 2
 160 = 7966 1
 170 = 1549 B
 180 = 6299 6
 190 = 3E7F C
 200 = 910D 9
 210 = DBCF 0
 220 = 8AFC 5
 230 = 9EE3 8
 240 = FD2E C
 250 = 9719 4
 260 = 28E7 5
 270 = 2503 3
 280 =  B92 9
 290 = F9B4 5
 300 = F301 D
 310 =  EB7 9
 320 = EC23 B
 330 = 8E7E 7
 340 = 4BC5 2
 350 = 9224 1
 360 = 1E78 4
 370 = 9224 8
 380 = 7155 0
 390 = 6C79 F
 400 = F35E 7
 410 = AA5A B
 420 = 367E 5
 430 = 95FA 5
 440 = 624B D
 450 = 670E E
 460 = 74FB 3
 470 = CC04 9

 480 = 5525 7
 490 = 5DFD D
 500 = 1A09 D
 510 = 1A09 9
 520 = 1A09 F
 530 = F564 A
 540 = 8D00 E
 550 =  423 4
 560 = D807 C
 570 = 95FA 2
 580 = FF68 3
 590 = 1A09 2
 600 = 1A09 4
 610 = 1A09 E
 620 =  B75 3
 630 = 2C4A 5
 640 = 5844 A
 650 = 6B55 B
 660 = B52C 4
 670 = 21EE 1
 680 = D5B1 3
 690 = 7E50 2
 700 = EC23 2
 710 = 8E7E C
 720 = C708 3
 730 = E7C7 7
 740 = CF0F 2
 750 = 3285 E
 760 = FB75 F
 770 = 37CE 4
 780 = 51B4 6
 790 = 336A 5
 800 = 8E7E 0
 810 = 7602 2
 820 = FB22 C
 830 =  63A 7
 840 = 56FC C
 850 = 7898 2
 860 = C975 3
 870 = 8579 4
 880 = E44E 4
 890 = 735B 6
 900 = 2772 C
 910 = 4C49 7
 920 = 2786 C
 930 = 3559 0
 940 = F35E 8

 950 = 4838 5
 960 = 9A8B E
 970 = DC83 C
 980 = 9843 9
 990 = 9CCF 4
1000 = 7155 C
1010 = 8579 7
1020 = FB75 D
1030 = FDA4 7
1040 = 9719 E
1050 = AC9E A
1060 = AC64 1
1070 = 8D00 A
1080 = 8229 5
1090 = 3EB8 7
1100 =  7B7 3
1110 = 29E8 6
1120 = 5E7E C
1130 = 78D9 E
1140 = CC88 7
1150 = 7235 1
1160 = 7235 4
1170 = 7235 D
1180 = 7235 2
1190 = 74FB 4
1200 =  270 6
1210 = E018 4
1220 = 9843 F
1230 = 9719 B
1240 = CDA1 0
1250 = B7C3 F
1260 = 56FC 2
1270 = 7898 2
1280 = 8F4F 8
1290 = 824E A
1300 = 5DFD 7
1310 = 2772 6
1320 = 4E8A B
1330 = 2D4D D

1340 = 3242 7
1350 = 673F 6
1360 = FD5B A
1370 = 4470 7
1380 = 9843 4
1390 = 9719 9
1400 = 8C61 E
1410 = 805E 1
1420 = D30C 5
1430 = 86E4 F
1440 = 824E D
1450 = 5DFD E
1460 = 824E 1
1470 = 6ECC 0
1480 = 824E D
1490 = 881D 9
1500 = 43A3 4
1510 = B8AA 4
1520 = AC64 D
1530 = A9B1 E
1540 = 6E04 9
1550 = D152 D
1560 = 5CD2 A
1570 = 78F4 5
1580 = 5116 2
1590 = CABE B
1600 = 3ED4 E
1610 = 73A4 A
1620 = 9DB9 C
1630 = 62D8 7
1640 = D2A4 D
1650 = C285 C
1660 = 43A3 A
1670 = 49A5 C
1680 = AC64 D
1690 = A9B1 4
1700 = 76B7 7
1710 = 8D00 1
1720 = 8229 E

1730 = E36F 5
1740 = C2EE 0
1750 = 772F 9
1760 = CFA3 C
1770 = C2EE A
1780 = CABE 0
1790 = CFA3 5
1800 = C2EE 2
1810 = DFB9 8
1820 = AFEA 9
1830 = 5A2F 5
1840 = 1334 B
1850 = 1BAE D
1860 = 2189 F
1870 = 62BA 5
1880 = 1776 E
1890 = D557 F
1900 =  E5F 0
1910 =  DA4 1
1920 = 7ECB 0
1930 =  2BC 4
1940 = 4E8A B
1950 = 772F D
1960 = 4E8A F
1970 = 670E D
1980 = 4E8A 5
1990 = 5373 A
2000 = 4C9A B
2010 = 9843 8
2020 = 9719 1
2030 = 64A5 F
2040 = F646 0
2050 = F4E8 7
2060 = 5A37 3
2070 = C5AF 4
2080 = 7602 C
2090 = F4E8 B
2100 = 18ED 5
2110 = C5AF 0
2120 =  423 6
2130 = 5CEF C
2140 = 24AB 7
2150 = BB7D B
2160 = 7155 E
2170 = BDA3 F
2180 = 1089 D
2190 = A484 5

2200 = 6B67 5
2210 = 5A04 9
2220 = 4749 3
2230 = 3E05 B
2240 =  176 1
2250 = 5BFE 1
2260 = 8DD4 9
2270 = EB66 7
2280 = F64E D
2290 = 5432 B
2300 = ADF9 D
2310 = FA96 3
2320 = 88F2 3
2330 = 8306 1
2340 = 6E71 9
2350 = 3E05 5
2360 = FA57 5
2370 = 5BFE 8
2380 = AE30 4
2390 = C2DB C
2400 = 5A11 1
2410 = FD92 2
2420 = 670E D
2430 = 7602 2
2440 = ABC7 7
2450 = 3E05 1
2460 = 9719 8
2470 = 74FB 0
2480 =  423 3
2490 = BF47 A
2500 = 95FA C
2510 = 4754 6
2520 = F6BD 8
2530 = FA59 A
2540 = 24AB A
2550 = E861 3
2560 = 5525 A
2570 = 8C6B A
2580 = 99CD 1
2590 = A584 8
2600 = 56FC B
2610 = 84EA 3
2620 = 5E7E C
2630 = 7737 4
2640 = 2A3B E
2650 = F564 3
2660 = BC08 B

2670 = 9843 E
2680 = 5FC0 6
2690 = B8FA 8
2700 =  D64 2
2710 = BA51 B
2720 = 8D3A 3
2730 = 7602 E
2740 = 431B 7
2750 = E8A9 B
2760 = 3D2E 4
2770 = 81B9 C
2780 = 955B 3
2790 = C861 1
2800 = 9A43 A
2810 = 77A9 9
2820 = 6623 6
2830 = AE30 D
2840 = 4C03 9
2850 = 9B97 3
2860 = 74FB 3
2870 = 1677 7
2880 = 367E 6
2890 = 5CEF 0
2900 = 5BCB A
2910 = CC04 E
2920 = 10C0 5
2930 = 8D00 D
2940 = E861 0
2950 = 66F2 8
2960 = BB7D F
2970 = F0C9 9
2980 = 79B7 8
2990 = 1037 E
3000 = C7A2 A
3010 = 9843 0
3020 = A051 3
3030 = E2BF F
3040 = AE67 0
3050 = E2BF 7
3060 = 72A7 8
3070 =  B2B B
3080 = 5192 0
3090 = E2BF B
3100 = 113A 0
3110 = 7BCC 3
3120 = 3802 0
3130 = 9D7C 3

3140 = DBDC 3
3150 =  C55 8
3160 = EE5A A
3170 = B4E7 7
3180 = D1FA A
3190 = B4E7 F
3200 =  335 F
3210 = E2BF 1
3220 = CAC5 4
3230 = E2BF 2
3240 = B5E3 3
3250 = E2BF B
3260 = 6327 D
3270 = E2BF A
3280 = B211 D
3290 = E2BF 7
3300 = A3B2 1
3310 = E2BF 6
3320 = 18C9 6
3330 = E2BF A
3340 = 658C 2
3350 = E2BF 9
3360 = CAFA 1
3370 = E2BF 2
3380 = AED4 4
3390 = AED4 B
3400 = 73CE F
3410 = E2BF 9
3420 = 8C5F 3
3430 = 92BC 8
3440 = B75E 1
3450 = E2BF E
3460 = 6439 3
3470 = E2BF 0
3480 = 4B7D 8
3490 = AED4 1
3500 = AED4 4
3510 = AED4 D
3520 = AED4 0
3530 = AED4 2
3540 = AED4 9
3550 = 9719 3
3560 = 8B58 E
3570 = 818D 1
3580 = C66B 6
3590 = 2C83 B
3600 = ED0F 1
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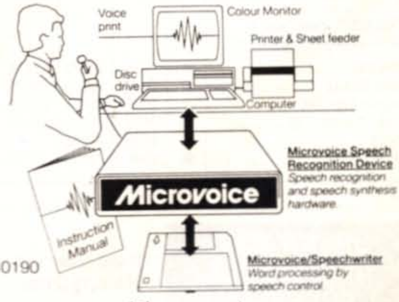

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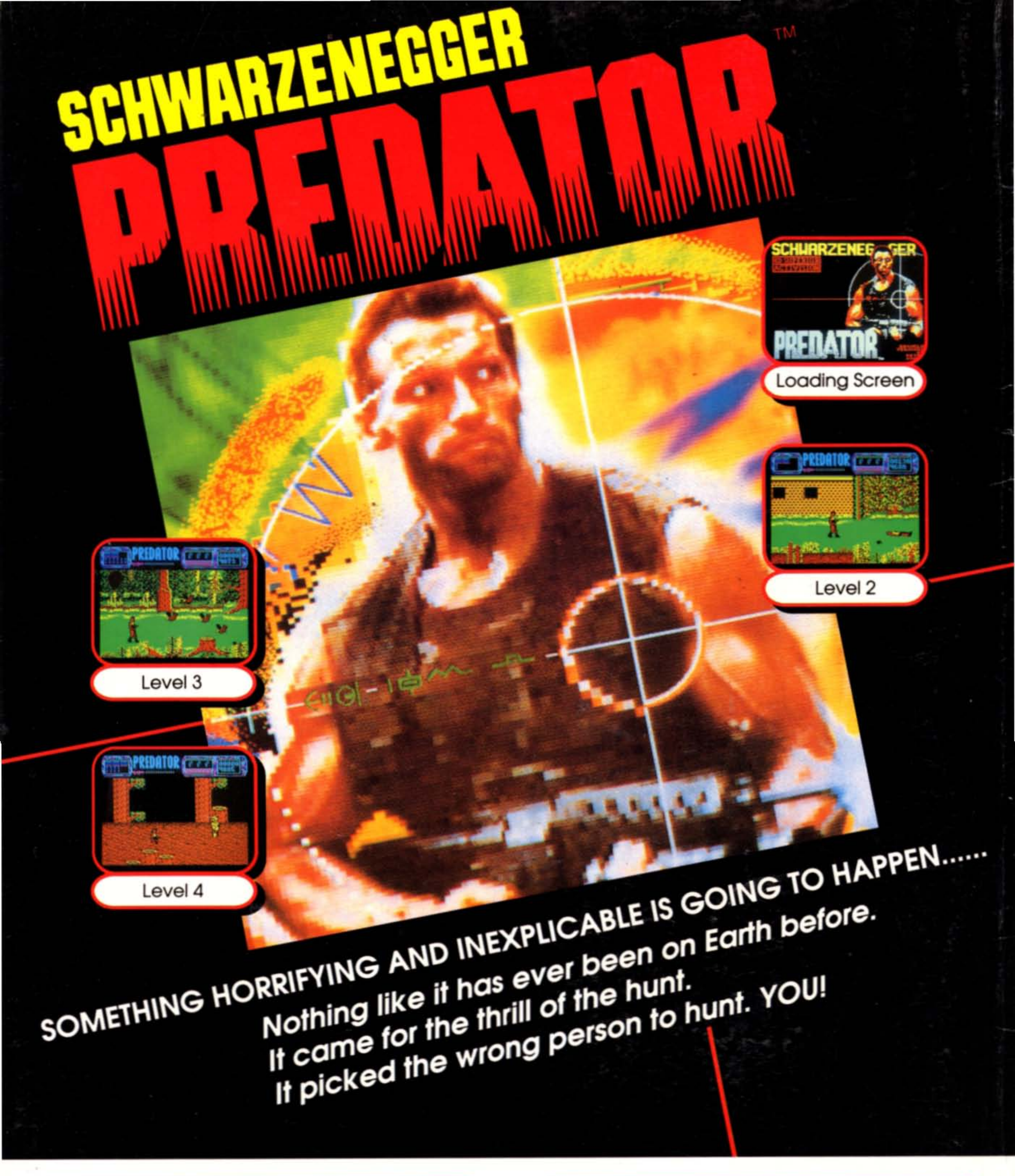

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